When Two Become One:

Foreign Capital and Household Credit Expansion*

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Abstract

Rapid credit expansions predict lower output growth and banking crises, but does it matter who is financing them? To answer this question, we identify the ultimate counterparties financing credit expansions in a novel data set covering 33 countries. We find that foreign-financed household credit expansions predict lower future GDP growth and higher risk of crises, but domestically financed credit expansions do not. We link these patterns to depressed domestic demand driven by higher debt service payments to foreigners, reversals in foreign financing, and confirm the findings using an instrumental variable based on lending dynamics in the international banking network.

Keywords: Business cycles, capital flows, debt service, financial crises, global financial cycle, household debt.

JEL classification codes: E32, E44, F34, G01, G15, G51

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1. Introduction

Rapid credit expansions are associated with banking crises and predictably worse macroeconomic outcomes (Schularick and Taylor, 2012; Mian et al., 2017). To understand these dynamics, recent research has focused on the type of borrower and the constraints they are facing (Mian et al., 2020; Müller and Verner, 2021; Jordà et al., 2022). However, there is no systematic evidence on who finances credit booms, while the financing counterparty is likely to matter for refinancing risks, the direction of future repayment flows and the transmission of credit expansions to the real economy. Narrative accounts of historical crises emphasize the role of one particular counterparty – foreigners – in financing the booms that precede crises (e.g., Kindleberger, 1978).[1] While an earlier literature found some evidence for this view (see Calvo et al., 1996), after the global financial crisis the focus shifted towards domestic credit as the main culprit, largely neglecting the international dimension (Sufi and Taylor, 2021).

Domestic credit, however, can still be financed by foreigners and this may matter for the macroeconomy. But this channel has been difficult to test. Empirically, the main challenge is that credit statistics do not include a breakdown by ultimate financing counterparty that would allow assessing the role of foreign-financed credit. In times of large two-way capital flows among advanced economies (Shin, 2012) this breakdown is crucial to capture the accumulation of gross foreign liabilities that ultimately have to be repaid by domestic borrowers, and to reflect the fragility of financial intermediary balance sheets arising from the transformation of fickle foreign capital into long-term domestic credit (Obstfeld, 2012; Borio, 2016).

In this paper, we introduce new financial accounts data for 33 countries since the 1970s to study the links between the financing of credit expansions and macroeconomic outcomes. We use this data, newly digitized for the years before 1995, to 'unveil' the balance sheets of financial

[1] "*Any reader of this book will come away with the distinct notion that large quantities of liquid capital sloshing around the world should raise the possibility that they will overflow the container*" as noted by Robert M. Solow in the foreword to the recent edition, Aliber and Kindleberger (2015).

intermediaries, building on Mian et al. (2021b), and decompose domestic credit by its ultimate financing counterparty: domestic households, the government or the foreign sector. This allows us to trace the transformation of gross capital flows into domestic credit, overcoming the challenges described above. Based on this new decomposition, we document who financed the secular increase in credit relative to GDP, study the link between credit expansions and business cycle outcomes through the lens of the counterparties financing credit, and investigate the underlying mechanisms.

Our results show that domestic household credit ultimately financed from abroad is key: it is both a major driver of the increase in credit-to-GDP ratios since 1970, and the crucial link between credit expansions and business cycle outcomes. Expansions in externally financed household credit are followed by a short-lived boom and a subsequent bust in GDP, and are associated with significantly elevated risk of banking crises. Importantly, neither credit to the non-financial corporate sector nor domestically financed household credit are associated with these dynamics. Focusing on the mechanisms in more detail, we find that the link between foreign-financed household credit and subsequent GDP growth is strongest under fixed and weakest under floating exchange rate regimes. Decomposing GDP, we find that most of the negative medium term response is due to depressed consumption, which we link to debt service payments flowing abroad following a foreign-financed household credit boom. Finally, we exploit supply shocks in the international banking network (based on Amiti et al., 2019) as an instrument, which confirms a strong link going from the foreign supply of funds to domestic household credit and subsequent macroeconomic outcomes.

Our paper thus reconciles the literature on domestic credit expansions and their macroeconomic implications (Schularick and Taylor, 2012; Mian et al., 2017) with the literature on capital flows and the global financial cycle (Calvo et al., 1996; Reinhart and Rogoff, 2009; Rey, 2013). We show that the combination of the two is crucial. Domestic credit expansions predict lower GDP growth, but only when they are financed with capital from abroad, while capital inflows predict macroeconomic dynamics when large gross flows are used to finance domestic household credit.

Key to our analysis is the unveiling exercise linking borrowers to ultimate financing counter-

parties, similar to the procedure applied in Mian et al. (2021b) to the United States flow of funds data. Put simply, this methodology assigns credit on the asset side of intermediary balance sheets to the different counterparties that finance intermediary sector liabilities, lifting the veil of financial intermediation. We use the financial accounts data[2] to implement this unveiling approach in a broad panel of OECD countries.[3]

We start by mapping out the evolution of financial intermediation over the last decades. The textbook model of financial intermediation ties household savings to bank deposits, which in turn finance loans to non-financial corporations. Our data suggests that this model was an adequate description of the credit intermediation process until the early 1980s, but it no longer is. On the borrowing side, domestic households play an increasingly important role, as previously documented in, e.g., Jordà et al. (2016). At the same time, the data shows that there has been a shift away from domestic households and towards the foreign sector as a counterparty financing credit.

The growing reliance on cross-border financing has important implications for business cycles. While foreign financing of household debt may allow for better risk sharing, it could also increase the macro-financial vulnerabilities associated with credit. We hence study the role of different counterparties for the relationship between credit expansions and business cycle outcomes. We find that the driving force behind the relationship between total household credit and business cycles, documented in Mian et al. (2017), is the foreign-financed component of household credit. It is responsible for the documented short-lived boom in economic activity, as well as the significantly lower economic growth over horizons of more than three years. Importantly, household credit financed by domestic sectors, as well as credit to the corporate non-financial sector, are neither associated with a short-lived boom, nor with the subsequent slowdown in economic activity. The

[2]Financial accounts are compiled by statistical agencies as part of the system of national accounts (SNA 2008 and its predecessors) and contain stocks and flows of financial instruments by economic sector: domestic households, the government, non-financial corporations, financial corporations, and the rest of the world (RoTW), where the latter includes all financial relationships of domestic agents with foreigners.

[3]We cross-validate results from the baseline approach used in the broad panel against approaches making use of the more granular data from the U.S. and recent (from the ECB) as well as historical (from the OECD) cross-country data containing granular counterparty information by financial instrument.

relationship is strongest in countries with exchange rate pegs, while floating rate economies with independent monetary policy seem to be less sensitive to these dynamics.

We next study whether intermediation between international capital markets and domestic households through financial sector balance sheets puts a country's financial stability at risk (Reinhart and Rogoff, 2009; Calvo, 2011). We find that funds sourced from abroad and lent out to domestic households are the most important link in the widely documented relationship between credit and crises. Specifications including this single variable achieve higher predictive accuracy than models including non-financial corporate credit decomposed by counterparty, domestically financed household credit, and net capital flows. Intuitively, financing long-term household credit with flighty foreign capital creates maturity mismatches and increases the fragility of financial intermediaries. In line with this idea, we find that the contraction in credit following banking crises is almost exclusively driven by a reduction in credit financed ultimately by foreigners.

What are the economic mechanisms behind our findings? One potential explanation could be that foreigners finance only the largest household credit booms, and business cycle dynamics are linked to size, rather than the financing counterparty of a credit expansion. To study this hypothesis, we focus on a set of large household credit booms and split them by their main source of financing. We find that these large booms are only followed by credit cycle reversals and adverse economic outcomes when predominantly foreign-financed. When financed domestically, they are followed by average growth dynamics.

Which theories predict that the interaction of borrowing sector – households – and financing sector – foreign counterparties – is key for macroeconomic dynamics? Starting from the borrower side, there is a growing literature that incorporates heterogeneity into models of household debt. The idea is that household borrowing today may weigh on future aggregate demand if borrower households are financially constrained or have a high marginal propensity to consume out of their income (Korinek and Simsek, 2016; Farhi and Werning, 2016; Mian et al., 2021a). This is because borrowing today comes with future debt service payments to creditors (Drehmann et al., 2023),

and the recipients of these payments may consume less of their income. When foreigners are the recipients of debt service flows, they naturally have a low marginal propensity to consume out of their income domestically (presumably even lower than the rich households in Mian et al., 2021a).

Our results, based on the new decomposition of ultimate financing counterparties, are in line with this channel. When we split GDP into its components and study their relationship with foreign-financed household credit expansion, we find that the negative medium-term response of GDP is mostly driven by depressed consumption. We also show that debt service payments to foreigners, resulting from foreign-financed household credit, are indeed associated with lower subsequent consumption and GDP growth. Consistent with our finding that the relationship is muted in floating exchange rate economies, this channel could theoretically be offset by monetary policy as argued in Schmitt-Grohé and Uribe (2016). In sum, our results suggest that the counterparty financing credit matters, with foreign counterparties exhibiting a higher propensity to withdraw funding during financial turmoil and a lower propensity to consume the income they receive from debt service payments domestically.

In the final part of the paper we employ the Amiti and Weinstein (2018) methodology to construct a measure of foreign supply of capital, and use it as an instrument for foreign-financed household credit expansion. We decompose bilateral international banking flows into a global cycle component, as well as country-specific supply and demand shocks (as in Amiti et al., 2019) and then compute the foreign supply of capital as the combination of country-specific supply shocks from international markets and the global cycle component. We use this measure, orthogonal to country-specific demand by construction, as an instrument for foreign-financed household credit expansion to better identify the effects of credit supply. Across all specifications the coefficients for instrumented foreign-financed household credit remain highly significant. Moreover, they are larger than our baseline coefficients, suggesting that these specifications, if anything, underestimate the macroeconomic dynamics associated with foreign-financed household credit expansion.

Do market participants and economic forecasters understand the macroeconomic dynamics

associated with foreign-financed household credit? When we look at growth forecast errors, we find that IMF staff forecasts are unaffected by household lending booms financed with foreign capital. Hence, forecasts turn out to be overoptimistic (as for total household credit in Mian et al., 2017). Importantly, this is not the case for domestically financed household credit expansions. Similarly, bank shareholders do not seem to ask for higher compensation during foreign-financed household credit expansions which consequently predict low subsequent returns on bank stocks. This result is similar to Baron and Xiong (2017), but again exclusively driven by the foreign-financed component of household credit. Together, our results suggest that instead of being linked to domestic investment opportunities, foreign financing often reflects capital supply dynamics from the global financial cycle in line with Rey (2013), without expectations adjusting to predictable dynamics associated with these credit expansions.

Contribution to the literature. The paper contributes to several strands of literature. First, there is a large literature that connects domestic credit market conditions to the business cycle and banking crises. Several papers have linked output dynamics and crisis incidence to rapid credit expansions (Borio and Lowe, 2002; Schularick and Taylor, 2012; Mian et al., 2017, 2020). Müller and Verner (2021) and Jordà et al. (2022) show that the composition of borrowers during credit expansions matters. On the other side of the financial sector balance sheet, Hahm et al. (2013) and Jordà et al. (2021) highlight the role of liability composition of the banking sector for crisis dynamics. Our paper shows that the identity of the counterparty financing these liabilities is key to understanding the macroeconomic dynamics around credit booms, assigning an important role to foreign counterparties. Studying the transmission channel in more detail, Drehmann et al. (2023) highlight the role of debt service payments of borrowers. We add that outcomes depend strongly on the counterparty ultimately receiving these debt service payments. This result is in line with a large body of theoretical literature emphasizing heterogeneity in financial constraints or marginal propensities to consume as potential channels for debt to affect aggregate outcomes (Farhi and Werning, 2016; Korinek and Simsek, 2016; Schmitt-Grohé and Uribe, 2016; Mian et al., 2021a).

Second, the paper contributes to the literature linking international capital flows to financial instability. In fact, concerns about imbalances and a global savings glut (Bernanke, 2005) preceded the global financial crisis. In most of the literature studying this question, the focus has been on the current account as a measure of capital flows, which has resulted in mixed findings (Jordà et al., 2011; Kiley, 2021). Gourinchas and Obstfeld (2012) conclude that the empirical evidence for capital flows being associated with crises is much more mixed than for domestic private credit. However, as noted above, credit extended by the domestic banking sector may still be financed externally, with implications for the macroeconomy. Our new data allows us to test this prediction for the first time directly.[4] We show that, once credit is decomposed by counterparty sector, it is exactly the transformation of foreign capital into domestic lending that puts financial sectors at risk (Calvo, 2011). Importantly, we find that this transformation reflects large gross capital flows and is not necessarily captured by net measures (Shin, 2012; Borio and Disyatat, 2015; Borio, 2016).

Third, the paper also contributes to the literature on liquidity and financial instability. Our measures of credit by financing counterparty capture the refinancing- and run-risks associated with different counterparties (Diamond and Dybvig, 1983). Several recent contributions present micro-level evidence on the run-risk of different creditor groups (Iyer and Puri, 2012; Iyer et al., 2016; Falato et al., 2021; Blickle et al., 2022) and the financial and real implications of the sectoral composition of owners of financial assets (Coppola, 2021; Bretscher et al., 2022). We add an aggregate view to this literature, showing that banking crises are more likely if long-term household credit is ultimately financed with capital from a particularly run-prone group of investors – foreigners (Broner et al., 2013; Forbes and Warnock, 2012; Caballero and Simsek, 2020). These reversals in the foreign supply of capital also link our findings to the literature identifying the lack of credit supply and the forced deleveraging after crises as an important channel from financial fragility to macroeconomic outcomes (Chodorow-Reich, 2014; Huber, 2018).

Fourth, a recent literature has highlighted the important role of a global financial cycle (Rey,

[4]Previous studies focusing on this channel had to rely on the interaction between measures of capital flows and lending booms, again with mixed results (Benigno et al., 2015; Davis et al., 2016; Caballero, 2016; Mian et al., 2017).

2013; Miranda-Agrippino and Rey, 2020). Bruno and Shin (2015) argue that this cycle is transmitted through the balance sheets of globally operating banks and di Giovanni et al. (2021) show evidence for such a transmission at the micro-level for Turkey. Aldasoro et al. (2020) argue that domestic and global financial cycles come together around crises. We show that this synchronization results from interlocking balance sheets of domestic households, banks, and the foreign sector, linking the global financial cycle to the macroeconomic consequences of household credit expansions.

More generally, our paper contributes to the understanding of secular trends in the structure of the global financial system. Several studies have documented the growth of finance in advanced economies (Philippon and Reshef, 2013; Greenwood and Scharfstein, 2013). As shown by Jordà et al. (2016), household credit has been a main contributor to increasing debt levels over the past decades. At the same time, lending across borders surged (McCauley et al., 2021). Our unveiling exercise shows that these trends are two sides of the same coin: household borrowing is increasingly financed across borders, with important implications for financial stability and the macroeconomy.

2. Data, unveiling methodology, and trends

Our main data source for credit aggregates and their decomposition are sectoral financial balance sheets, which are compiled by statistical agencies as part of the national accounts framework. As a result, the data is fully consistent with other variables used to study macroeconomic effects and transmission channels. The data comes in three distinct formats. The most recent version are the financial balance sheets based on the System of National Accounts 2008 (SNA2008). Before the 2008 revision, financial balance sheets are based on the 1993 version (SNA93). Both series are published online and generally cover the post-1995 period for OECD economies.

To extend the coverage of the series, we link this data to *newly digitized financial accounts data* from historical publications of the OECD. This data was published in yearly "golden books" by the OECD up until 1998 (OECD, 1970-1998). A snapshot is shown in Figure A1.1. Since the data is frequently revised and updated, we use the most recent data whenever available, and overlapping

years to link variables across data sets and extrapolate recent data backwards with growth rates in historical data. The resulting data set contains an unbalanced panel of 33 countries starting in the 1970s. Table A1.1 in the appendix contains an overview of the available years of data for each country. Whenever available, we use non-consolidated data.[5]

Financial accounts contain information on stocks and flows of financial instruments by economic sector. We focus on stocks which are structured as sectoral balance sheets.[6] For each sector, the data contains the outstanding amounts of assets (claims) and liabilities by financial instrument.[7] Figure A1.2 provides an overview of sectors and financial instruments available in the baseline data. An important feature of the data is that each claim held by one agent must be recorded as a liability in the balance sheet of some other agent in the economy. As a result, the sum over all sectors of, e.g., deposits recorded as assets must be equal to the sum of all deposit liabilities. Financial relationships of domestic agents with foreign counterparties are recorded in the sector rest of the world. The assets of the rest of the world sector correspond to external liabilities of the respective country reported in the Lane and Milesi-Ferretti (2018) data. All three data sets are structured in the same way, with more recent data expanding on recorded subsectors and financial instruments. Whenever available, we complement this data with additional counterparty information, i.e. the identity of the sector holding a claim on another sector's liabilities. Our baseline unveiling approach does not depend on counterparty data, due to limited availability, but we validate our unveiling results for the subset of observations where granular counterparty data is available.

2.1. Trends in the raw data

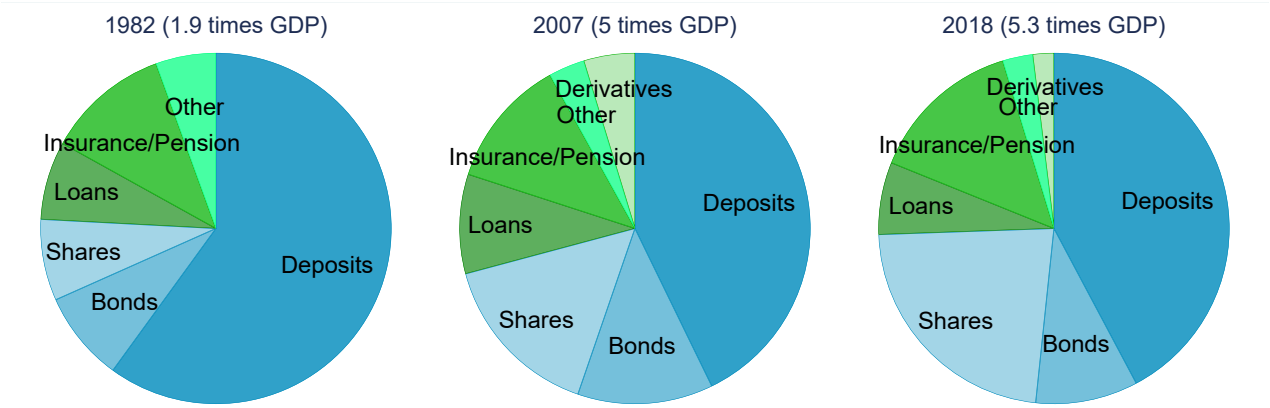
Eventually, we want to link the borrowing of one sector to the asset holdings of other sectors, who ultimately supply these funds and study trends and cycles in these ultimate borrower-creditor

[5]We use consolidated data for Australia which does not publish data in the unconsolidated format. In robustness checks, we also confirm that results hold using consolidated data for all countries instead.

[6]The baseline set of sectors comprises of domestic households and NPISH, government, financial corporations, non-financial corporations, and foreigners (rest of the world). In many cases, the data contains more granular sectoral information. We exploit this data in our robustness exercises for the unveiling.

[7]Reported financial instruments include bonds, loans, shares, deposits, derivatives, insurances, gold/SDR, and other instruments.

Figure 1: *Liability composition of the financial sector*



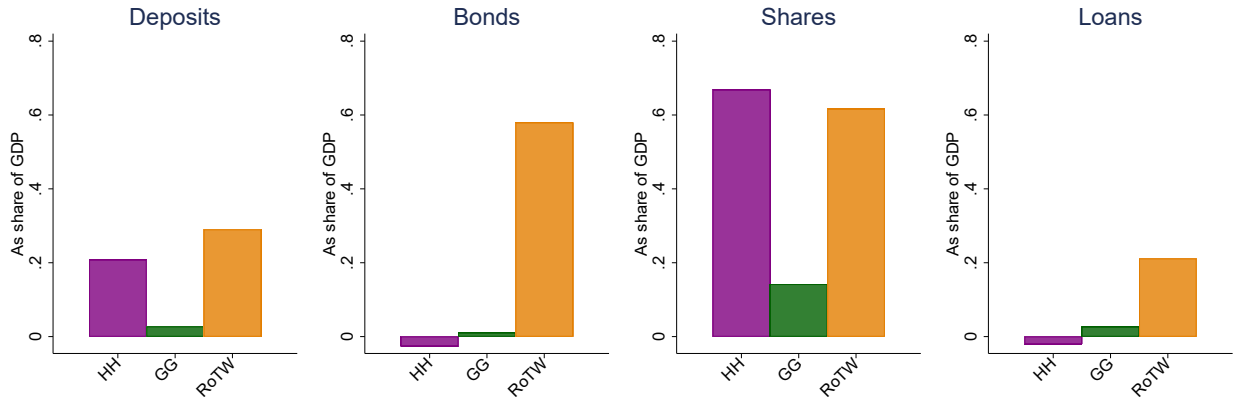
Notes: This graph shows the average composition of total liabilities of the financial sector by financial instrument for a stable sample of countries (Austria, Canada, France, Germany, Japan, Spain, Sweden, and United States) at different points in time. The header contains information on the size of financial sector liabilities relative to GDP.

relationships. Changes in borrowing sectors, with households surpassing corporations as the principal debtors over the last decades, have been widely documented (Jordà et al., 2016; Müller and Verner, 2021). At the same time, to fund loans to borrowers, the banking sector increasingly relies on non-core liabilities – non-deposit debt liabilities – as shown in Jordà et al. (2021). In our data, this trend can be seen in Figure 1, showing which instruments are used by financial intermediaries to finance their assets, and thereby the loans to households and non-financials. The data display a shift away from deposits and towards financing via bonds and equities. While in 1982 more than 60% of financial sector liabilities were deposits, these only accounted for slightly more than 40% of liabilities on the eve of the 2007/2008 crisis.[8] At the same time, the size of financial intermediary balance sheets relative to the economy increased from a factor of two to more than five.

Accounting dictates that the growth in financial sector liabilities, particularly non-core liabilities, needs to be mirrored in the asset holdings of other sectors. To get a sense of changes in sectoral asset holdings and composition since 1982, Figure 2 shows the change in the holdings of the main financial instruments (relative to GDP) for the three ultimate financing sectors. The ratio

[8]There are two trends explaining this shift. First, as reported in Jordà et al. (2021) depository institutions have shifted from customer deposits to other sources of funds, especially wholesale funding markets, here reflected by bonds and derivatives. Second, the financial sector increasingly comprises of institutions other than depository institutions which, by definition, do not fund themselves with deposits. It is especially these sub-sectors funding themselves with shares (e.g. different types of mutual funds), leading to an increase in equity financing, while depository institutions operate with comparatively low levels of equity capital.

Figure 2: *Change in holdings of Instruments 1982-2018 in percent of GDP*



Notes: The figure shows the average changes in asset holdings at the sectoral level for a stable sample of countries (Austria, Canada, France, Germany, Japan, Spain, Sweden, and United States) between 1982 and 2018. The left panel shows the change in the ratio of deposit holdings to GDP for households, governments, and the rest of the world. The other panels show these changes for holdings of bonds, shares, and loans respectively.

of deposits held by the household sector relative to GDP increased on average by more than 20 percentage points between 1982 and 2018. Deposit holdings of the foreign sector increased by a similar amount over the same period. Looking at bond holdings in the middle left panel, the picture looks quite different. While households and the government saw little change, there has been an increase in the bond holdings of the foreign sector by about 60% of GDP. Both, households and foreigners, have increased their holdings of shares by more than 60% of GDP between 1982 and 2018. The right panel shows the change in holdings of loans. The foreign sector has increased its loan holdings relative to GDP by 20%. As it held only small amounts of all financial instruments in 1982, these changes imply a strong reallocation towards the foreign sector as a counterparty ultimately financing domestic credit. The following unveiling describes our approach to study this reallocation in a more systematic manner.

2.2. Unveiling

The goal of the unveiling is to allocate credit to households and firms to the counterparty ultimately financing this loan (as done for the U.S. in Mian et al., 2021b) for the largest possible sample of countries.[9] While a loan is normally held as an asset by a bank, the bank is not the ultimate

[9]Unlike Mian et al. (2021b), we do not study the distribution within the household sector.

counterparty providing financing. Banks finance loans on the asset side with equity, bonds, deposits or other financial instruments on the liability side of the balance sheet. A loan is thus ultimately financed by the agents that hold the bank's liabilities as an asset. 'Unveiling' the role of financial corporations implies linking the loan to the ultimate financiers. In line with Mian et al. (2021b), we assume that ultimate financing sectors (u) can be domestic households, the government, or the rest of the world ($u \in \{HH, GG, RoTW\}$).[10] Corporate sectors (c) that cannot be ultimate counterparties and are unveiled are non-financial and financial corporations ($c \in \{NF, FI\}$). The following section introduces our baseline unveiling procedure, which we label *proportional unveiling*, and its assumptions.

To allocate credit on the asset side of intermediary balance sheets to ultimate counterparties, we need to know which counterparties are financing intermediary liabilities. This information is, however, only available in a subset of data. We therefore rely on the accounting axiom that every liability is another agent's asset. Given the previously described data structure, we know the liability composition of any given sector, while observing the asset composition of all other sectors. In our baseline, we allocate liabilities proportionally to the sectoral distribution in holdings of this instrument as an asset. For example, we allocate deposits, used by the financial sector to finance loans, to a counterparty sector based on the share this sector has in total deposits in the economy (excluding the financial sector itself). When the household sector holds 70% of all deposits in the economy (excluding deposits held as assets by the financial sector), we assign 70% of the deposit liabilities of the financial sector to the household sector.

The key assumption we make here is that for a given financial instrument the mix of financing sectors can be computed based on the proportional asset holdings of all other sectors in that instrument.[11] Applying this assumption to data on all available financial instruments (deposits, bonds,

[10] Previous attempts to quantify the role of the rest of the world as a counterparty for domestic credit relied on net foreign asset positions by economic sector (Blanco et al., 2020) or a combination of direct borrowing from non-resident banks and net foreign financing of the financial sector (Avdjiev et al., 2012). By exploiting the entire balance sheet of all sectors, we can take a more holistic approach to the same question and account for the gross exposures of each sector in individual instruments and document, e.g., the transformation of foreign financing into domestic credit.

[11] The same assumption is, e.g., used in Vom Lehn and Winberry (2022) and by the BEA in the context of constructing

loans, shares, insurances and pensions, gold and SDRs, derivatives and options, other accounts) we estimate the total pairwise holdings from a sector s supplying financing to a receiving sector r. While in principle allowing all possible $s \rightarrow r$ relationships ($(r,s) \in \{HH, GG, RoTW, NF, FI\}$), we set the direct link from $RoTW$ to HH to zero. The reason is that households normally do not directly access international financial markets to borrow.[12] While we think this is a reasonable restriction based on observable data, it is important to note that this approach, if anything, underestimates the rest of the world as a funding source for household debt expansions.

To determine the ultimate counterparty financing household and non-financial corporate credit $C^{u \rightarrow b}$, with u being the ultimate supplying sector ($u \in \{HH, GG, RoTW\}$) and b the borrowing sector ($b \in \{HH, NF\}$) of credit C, we need to account for both direct and indirect links from u to b. While we calculated the direct link above, we still need to account for indirect links, which can be very important as credit is usually intermediated. These indirect links can take two forms. First, borrowers and u-sectors could be linked via one intermediary, e.g., domestic households holding deposits of financial intermediaries which then lend to other households. Second, there could be more than one intermediation step: e.g., consumer loans to households made by non-financial corporations could be financed with loans from financial intermediaries. To correctly assign credit to the ultimate counterparty, we first estimate the total holdings of u sectors in intermediary corporate c-sectors ($c \in \{NF, FI\}$) and then allocate the claims c-sectors might have on borrowing sectors b proportionally to the u sectors' share in financing c-sectors.

Finally adding up direct and indirect links from $u \rightarrow b$, yields the credit of borrowing sector b, financed by ultimate sector u. Note, that the liabilities of the household sector almost exclusively consist of loans. Corporates, on the other hand, also borrow using other financial instruments. Here, we focus on loans to be able to allow comparisons with other data sets and results in the literature.[13] Consequently, we denote our credit variable as $C^{u \rightarrow HH}$ for households and $C^{u \rightarrow NF}$ for

bilateral sectoral capital-flows tables in the United States.

[12] Whenever we observe counterparty information in the data, this number is close to zero. Allowing this direct link based on proportionality would therefore likely overestimate the importance of foreign financing for household credit.

[13] Our main results also hold when including bonds issued by non-financial corporates in $C^{u \rightarrow NF}$.

non-financial corporations. A detailed explanation of the baseline unveiling approach can be found in appendix section A2-1.

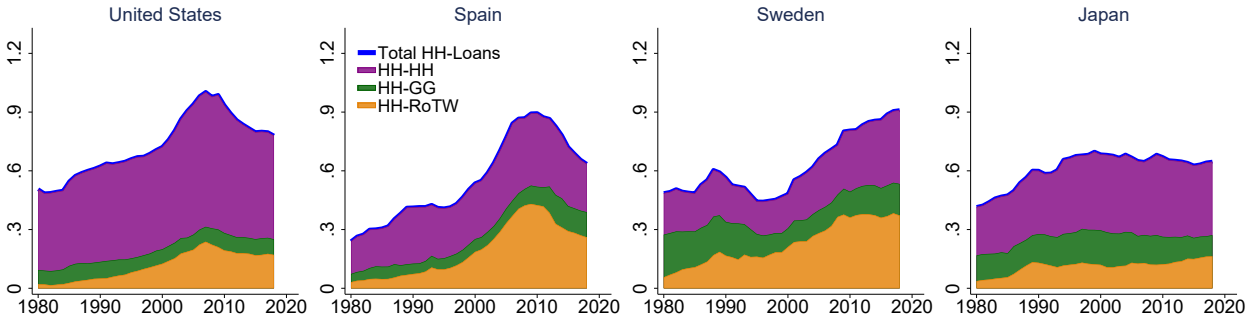
Our baseline unveiling is based on the broadest available sectoral breakdown of sectors. To validate our results we compare them to results using (i) additional counterparty information, (ii) the Mian et al. (2021b) replication files for the U.S., and (iii) additional subsector information (see A2 for details).

(i) Counterparty unveiling. We first resort to data where counterparty information is available, making the proportionality assumption in our procedure obsolete. Counterparty data is available from three sources. First, the newly digitized historical data from OECD golden books contain counterparties for some countries, covering the beginning of our sample period. Second, for recent years, detailed counterparty information is available from the ECB's 'who-to-whom-matrices' for Eurosystem countries. Third, the US financial accounts (flow of funds) contain counterparty information which is exploited in Mian et al. (2021b). The left two panels of Figure A2.3 use information from the historical publications and from ECB statistics for cross-validation for Spain and Sweden, two countries for which we have counterparty information from both historical and recent sources. In both countries, our baseline estimate of household debt financed from abroad is almost identical to estimates using either historical or recent counterparty information. More generally, the right two panels of Figure A2.3 show binscatters for the correlation between counterparty-based and our baseline estimates whenever both series are available. As can be seen, the two estimates resemble each other closely.

(ii) Comparison with Mian et al. (2021b). For further verification, we compare the estimates from Mian et al. (2021b), using their replication kit, to ours. There are some small level differences in the total household credit series, as they unveil mortgage and consumer credit only, but Figure A2.4 shows that the unveiled series mirror each other closely in levels and dynamics.

(iii) Additional sectors. In all these approaches, we treat the financial sector as one, but depending on availability we can also distinguish between several financial subsectors. In subsection A2,

Figure 3: *Household credit by ultimate counterparty for the U.S., Spain, Sweden, and Japan*



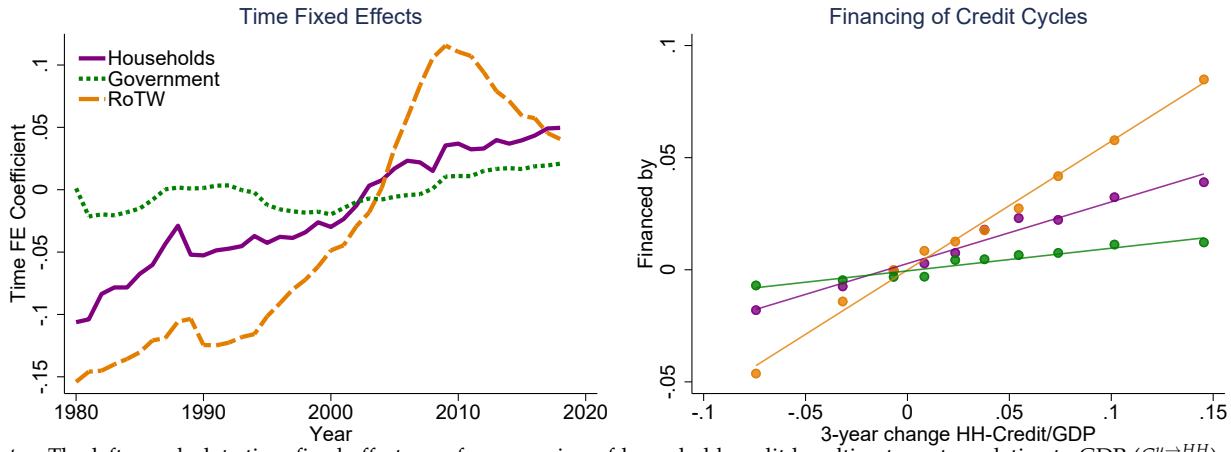
Notes: The figure shows the development of household debt financed by the three final sectors based on our baseline unveiling approach for the United States, Spain, Sweden, and Japan. All series are relative to domestic GDP. Household credit financed from domestic households, the government, and foreigners (RoTW) are shown in purple, green and orange respectively and add up to total household debt (blue line).

we describe in detail robustness approaches where we use a more granular sectoral breakdown available for subsets of data and additional exercises where we only allow for certain links between sectors, i.e. restrict some of the sectoral financial relationships to be 0. In addition, we perform a similar exercise in consolidated financial accounts data. The main takeaway from all these exercises is that the deviations from our baseline approach are rather small and all results hold using these alternative procedures.

2.3. Trends in the unveiled data

Figure 3 shows the results of the unveiling procedure for four countries with data going back to 1980 – the United States, Spain, Sweden, and Japan. The graph shows the development of household credit by counterparty, relative to GDP, since 1980. In 1980, household credit was financed almost entirely by domestic counterparties in all four countries, while foreign counterparties rarely financed household credit. After 1980, all four countries experienced increases in household credit to GDP, although cycles differ. As documented in Mian et al. (2021b), the increase in borrowing of U.S. households between 1980 and 2007 was financed to a similar degree by domestic households and foreigners, with both declining after 2007. Total household credit in Spain displays similar dynamics, but the boom was financed entirely from abroad. In Sweden and Japan foreign financing of household credit increased already before their respective financial crises in the early 1990s.

Figure 4: *Household credit by ultimate counterparty sector: trends and cycles*



Notes: The left panel plots time fixed effects α_t of a regression of household credit by ultimate sector relative to GDP ($C_{i,t}^{u \to HH}$) on country (α_i) and year (α_t) fixed effects, i.e. $C_{i,t}^{u \to HH} = \alpha_i + \alpha_t + \epsilon_{it}$, where u refers to domestic households, government, and the foreign sector respectively. The right panel shows the composition of three-year changes in total household credit by ultimate counterparty. Observations are collapsed into 10 equal sized bins based on three-year changes in the ratio of household credit to GDP. Each point represents the group specific means of three-year changes in total household credit and household credit financed by ultimate counterparty sectors relative to GDP, after controlling for country fixed effects. Fitted regression lines illustrate the correlation.

Afterwards, foreign-financed and total household credit remained stable (increased) in Japan (Sweden).[14]

Moving to the full sample, the left panel in Figure 4 shows the estimated time effects α_t of a regression of household credit by ultimate counterparty u relative to GDP on country (α_i) and year (α_t) fixed effects, i.e. $C_{i,t}^{u \to HH} = \alpha_i + \alpha_t + \epsilon_{it}$, where u refers to domestic households, government, and the foreign sector respectively. Since 1980, there has been a slight increase in household-financed household debt, while government-financed household credit is almost stable. On the other hand, household credit financed by foreign counterparties increased significantly between 1980 and the 2007/2008 crisis, declining afterwards, but remaining elevated. One concern is that these trends, and the role of foreign capital, could be entirely driven by Euro area financial integration. Hence, in Figure A3.10 we again calculate and plot yearly fixed effects, excluding the Euro area from the sample. Similarly, we exclude financial centers with very large RoTW positions (Iceland, Ireland, the Netherlands, Switzerland, and United Kingdom) in Figure A3.11. In both cases developments look very similar to the ones reported here.

[14]For a stable sample of countries Figure A3.9 displays the total increase in household and non-financial corporate loans relative to GDP along with the sources of funds for this increase. Household debt increased by 30% of GDP since 1980, with foreigners financing the largest share of this increase.

When we look at credit cycle variation, the right panel in Figure 4 shows that foreigners are also the marginal counterparty financing credit extended to the household sector at medium-term frequencies. The graph displays mean values of 3-year changes in the ratio of household credit (x-axis) and household credit by counterparty (y-axis) where the data have been collapsed into ten bins. Focusing on the highest decile, we observe that the average three-year change in the ratio of household credit to GDP is close to 15%. Almost two thirds of this increase in credit are financed by foreigners: the average three-year change in household credit funded by the rest of the world for this decile is close to 10% of GDP. Most of the remaining increase is financed by domestic households, while the government does not play an important role as a financing counterparty. Figure A3.12 replicates Figure 4 for the non-financial corporate sector, showing that corporate credit is likewise mostly financed with funds flowing in from the rest of the world.

3. Sources of credit and business cycles

How do these changes in the structure of financial intermediation affect the macroeconomy? Does increasing reliance on foreign financing alter the links between credit and business cycle dynamics? Recent models that link (household) credit expansion with macroeconomic dynamics usually rely on foreign-financed demand booms (Schmitt-Grohé and Uribe, 2016; Mian et al., 2020). Empirically however, this has been difficult to test. Mian et al. (2017) find limited evidence when they analyze accumulated current account deficits as a measure of foreign-financed household credit expansions. Our data on credit, disaggregated by the financing sector of funds, allows us to directly test the hypothesis that capital inflows intermediated to domestic households have consequences for macroeconomic dynamics.

3.1. Credit sources and macroeconomic dynamics: main results

To understand the business cycle dynamics associated with credit expansions financed from different sources, we decompose household and non-financial corporate credit by counterparty sector. We

first estimate local projections (Jordà, 2005), including six credit variables (two borrowing sectors b × three ultimate counterparty sectors u) to characterize the dynamics of output following an increase in the respective credit measure

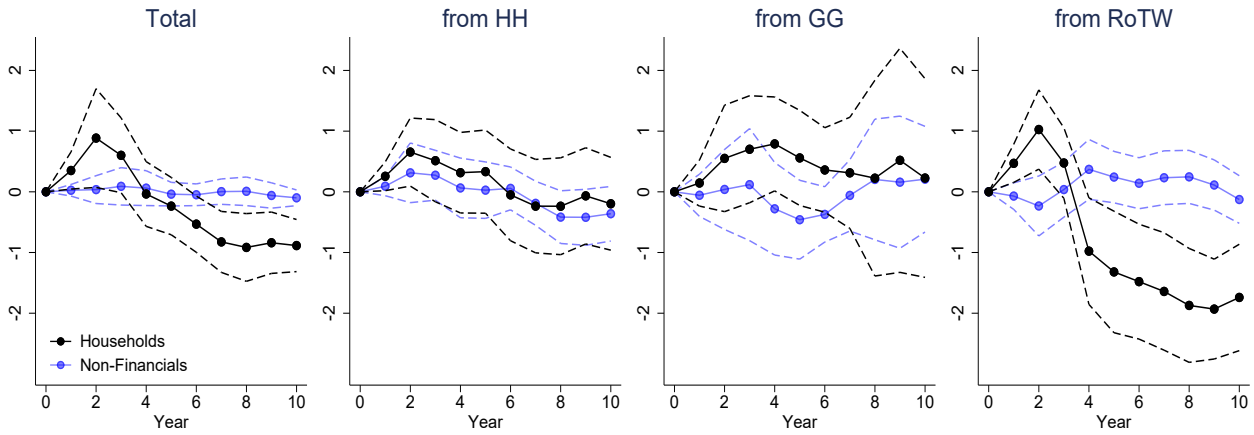
$$\Delta_h y_{i,t+h} = \alpha_{i,h} + \sum_{b \in B} \sum_{u \in U} \sum_{j=0}^{5} \beta_{h,j}^{u,b} \, \Delta C_{i,t-j}^{u \to b} + \sum_{j=0}^{5} \beta_{h,j}^{y} \, \Delta y_{i,t-j} + \gamma X_{i,t} + \epsilon_{i,t+h} \,, \tag{1}$$

where $\Delta_h y_{i,t+h} = y_{i,t+h} - y_{i,t}$ is the growth of log real GDP for $h = 1, ..., 10$. B contains households and non-financial corporates as borrowing sectors and U contains households, governments, and the rest of the world as ultimate counterparty sectors. $\Delta C_{i,t}^{RoTW \to HH}$, e.g., denotes the yearly change in the ratio of household credit financed by the RoTW sector relative to GDP. We will be interested in the $\beta_{h,0}$-coefficients for each of the six sectoral borrower-creditor combinations. The specifications control for contemporaneous GDP growth as well as five lags of GDP growth and of the credit variables. Recently, Brunnermeier et al. (2021) have argued that the response of output to credit is driven by the endogenous response of monetary policy to credit shocks. We therefore include the contemporaneous values and five lags of changes in short-term interest rates in $X_{i,t}$.

The results are presented in Figure 5, where we show the response of output to household and non-financial credit financed by domestic households, governments, and foreigners respectively. For comparison, the left panel shows results for a specification that includes total household and non-financial borrowing instead of decomposing these variables by counterparty. The results for this specification in our sample are very close to those in Mian et al. (2017). An increase in household credit (black) is associated with a short-lived boom in economic activity, but the response of cumulative output growth turns negative after year four. Cumulative output growth is then significantly lower six to ten years after the initial increase in household credit. The blue line shows that there is no such relationship for credit to the non-financial sector.

The three right panels in Figure 5 show the results from estimating Equation 1. All six responses are jointly estimated, but for ease of visibility presented separately by financing counterparty. The

Figure 5: *GDP responses to changes in credit by borrowing sector and ultimate counterparty*



Notes: This figure shows estimates of impulse responses of real GDP (in %) to increases in the ratio of household (black) and non-financial (blue) credit to GDP (left panel). The left panel shows responses to total household and non-financial credit for comparison. The three right panels show responses to increases in the ratio of household and non-financial credit decomposed by ultimate counterparty sector based on Equation 1. All six responses are estimated jointly but shown in three panels for better visibility. Dashed lines represent 95% confidence intervals around estimates computed based on standard errors dually clustered on country and year.

second panel shows the sequence of $\{\beta_{h,0}^{HH,HH}\}$ (black) and $\{\beta_{h,0}^{HH,NF}\}$ (blue) coefficients. The two responses are almost identical and an increase in credit financed by domestic households is associated with a small but insignificant increase in output first, and a response close to zero at longer horizons. The middle right panel shows the sequence of $\{\beta_{h,0}^{GG,HH}\}$ and $\{\beta_{h,0}^{GG,NF}\}$ coefficients. Increases in government-financed household credit are associated with a mostly insignificant increase in output until year 4, which reverses in the following years. The coefficients for government-financed increases in non-financial credit are close to zero and insignificant throughout. The dynamics for foreign-financed household credit presented in the far right panel are strikingly different. Initially, an increase in household credit financed from abroad is associated with higher output. This is reversed quickly, and starting in year 4 the cumulative response of output to an increase in household credit financed from abroad turns negative. The estimates for horizons larger than 4 years are all significantly negative. Non-financial credit financed by foreigners (blue) is not associated with such dynamics.

In sum, household credit financed by foreigners is strongly associated with a short-lived boom in economic activity followed by a bust, and it emerges as the main driving force behind the association between household credit and business cycles displayed in the left panel (mirroring

the results in Mian et al., 2017). At the same time, there is no relationship between credit to the non-financial corporate sector and business cycle dynamics, both in the aggregate or when credit is decomposed by counterparty sector. Hence, in the following analysis we will focus on the relationship between decomposed household credit and the macroeconomy.

In Table 1 we present corresponding results from a single-equation model commonly used in the literature (Mian et al., 2017; Müller and Verner, 2021). In particular, we estimate the relationship between three-year changes in household and non-financial credit, decomposed by ultimate financing source of funds, and subsequent real GDP growth and unemployment dynamics using the following specification

$$\Delta_3 y_{i,t+3} = \alpha_i + \sum_{b \in B} \sum_{u \in U} \beta^{u,b} \Delta_3 C_{i,t-1}^{u \to b} + \sum_{j=1}^{3} \beta_j^y \Delta y_{i,t-j} + \gamma X_{i,t} + u_{i,t+3}\,, \tag{2}$$

where $\Delta_3 y_{i,t+3}$ is the growth of real GDP (changes in unemployment) between time t and $t+3$, and $\Delta_3 C_{i,t-1}^{u \to b}$ is the three-year change in credit to borrowing sector b financed by sector u as a ratio to GDP. All specifications control for country fixed effects and lagged dependent variables. The results are presented in Table 1. In column (1), $\Delta_3 RoTW \to HH_{i,t-1}$ is the coefficient for lagged three-year changes in loans to the household sector financed ultimately by foreigners relative to GDP. A one percentage point increase in this variable predicts 0.9 percentage points lower output growth over the following three-year window, in line with the dynamic relationship displayed in the right panel of Figure 5. The relationship is highly significant and it is robust to the inclusion of year fixed effects in column (2). Like in Figure 5, there is no such relationship for other credit variables and a test for the equality of coefficients $\beta^{HH,HH}$, $\beta^{GG,HH}$, and $\beta^{RoTW,HH}$ is soundly rejected.

$\Delta_3 RoTW \to HH_{i,t-1}$ is a measure of gross positions of foreigners that are intermediated through the financial system to domestic households. As discussed earlier, the role of gross capital flows and asset/liability positions has been emphasized after the global financial crisis, while earlier literature focused on net flows, measured as current account dynamics. In column (3) we include changes

Table 1: *Credit expansion and subsequent macroeconomic outcomes*

	$\Delta_3 ln(Y)_{i,t+3}$				$\Delta_3 Unemployment_{i,t+3}$			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\Delta_3 RoTW \rightarrow HH_{i,t-1}$	-0.90***	-0.74***	-0.71***	-0.70***	0.30***	0.25***	0.22***	0.20***
	(0.20)	(0.17)	(0.17)	(0.18)	(0.05)	(0.04)	(0.03)	(0.03)
$\Delta_3 HH \rightarrow HH_{i,t-1}$	0.20	0.20	0.20	0.14	0.04	0.04	0.04	0.04
	(0.17)	(0.13)	(0.14)	(0.15)	(0.06)	(0.06)	(0.06)	(0.06)
$\Delta_3 GG \rightarrow HH_{i,t-1}$	-0.46	-0.28	-0.22	0.10	-0.08	-0.10	-0.13	-0.23*
	(0.30)	(0.28)	(0.27)	(0.31)	(0.09)	(0.10)	(0.10)	(0.12)
$\Delta_3 CA_{i,t-1}$			0.20*	0.15			-0.17***	-0.16***
			(0.11)	(0.10)			(0.04)	(0.04)
R^2	0.351	0.586	0.591	0.616	0.453	0.601	0.625	0.664
Country fixed effects	✓	✓	✓	✓	✓	✓	✓	✓
LDV	✓	✓	✓	✓	✓	✓	✓	✓
NF Credit	✓	✓	✓	✓	✓	✓	✓	✓
Year fixed effects		✓	✓	✓		✓	✓	✓
Additional Controls				✓				✓
p-value HH, $\beta_{RoTW} = \beta_{HH} = \beta_{GG}$	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00
Observations	678	664	663	596	634	621	620	566

Notes: This table presents results from estimating Equation 2. The dependent variables are the growth of real GDP and the change in the unemployment rate between year t and $t+3$. Household credit is decomposed by ultimate counterparty sector. Credit variables are expressed as lagged three-year changes in the ratio to GDP. LDV are distributed lags of the dependent variable. NF Credit includes non-financial credit decomposed by ultimate counterparty sector and additional controls include changes in household sector financial net worth and foreign capital not financing household credit (relative to GDP) as well as short-term interest rates. Standard errors in parentheses are dually clustered on country and year. The reported p-value refers to a test for the equality of credit coefficients by counterparty sector. *,**,*** indicates significance at the 0.1, 0.05, 0.01 levels, respectively.

in the current account to control for net flows. In column (4) we additionally include changes in financial net worth of the household sector, foreign capital not financing household credit and short-term interest rates. The coefficients for $\Delta_3 RoTW \rightarrow HH_{i,t-1}$ in columns (3) and (4) are almost unaffected by the inclusion of these variables, suggesting that foreign capital intermediated to domestic households plays an important role that is different from the role of net capital flows, total assets held by foreigners or household sector financial net worth.

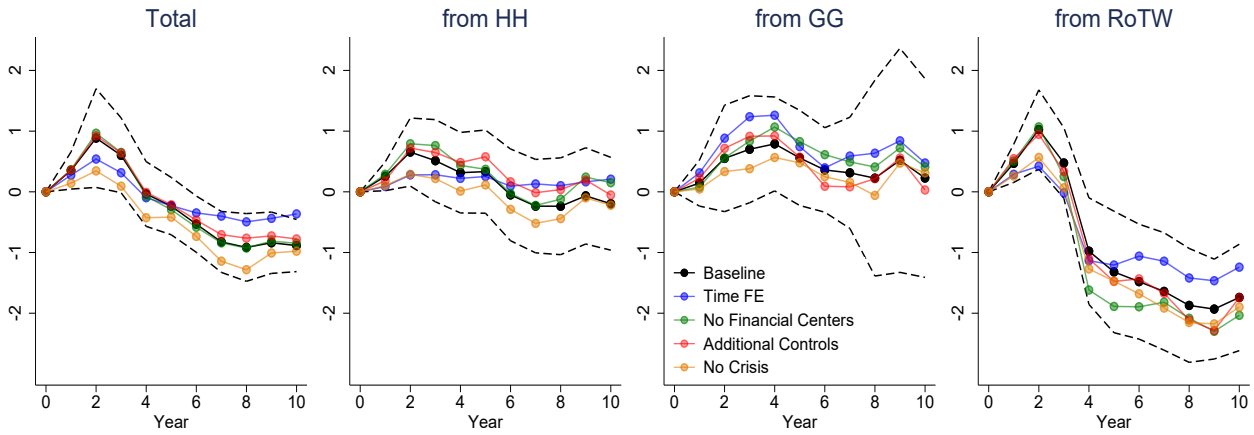
The negative relationship between foreign-financed household credit expansion and the business cycle also extends to unemployment, as columns (5) to (8) show. A one percentage point increase in foreign-financed household credit to GDP is followed by an increase of 0.30 percentage points in unemployment between year t and $t+3$. This relationship is robust to the inclusion of year fixed effects and including our set of additional controls.

3.2. Robustness

We conduct a battery of robustness checks for these findings. Figure 6 shows that the relationships between household credit by source of financing and GDP growth are a robust feature of the data. The panels show the baseline estimates for the relationship between foreign-financed household credit expansion and GDP growth from Figure 5 in black. We then add coefficients of several robustness specifications to the graphs. Red coefficients correspond to specifications that include additional controls: the current account-to-GDP ratio, household sector net financial positions, and foreign capital not financing household credit as in Table 1. The graphs show that adding these controls has very little effect on the main results. Figure A4.13 in the appendix shows the responses of GDP to these variables. When included jointly with household credit financed from abroad, the response of GDP to these variables is insignificant. On the other hand, when estimated separately for each variable, including only lags of the variable itself, lagged GDP and interest rate controls (Figure A4.14), the GDP response to the current account is similar as the response to foreign-financed household credit, while financial net worth of the household sector is robustly associated with subsequent GDP growth. Hence, these variables partly capture the relationship between foreign-financed household credit and subsequent macroeconomic dynamics when not including decomposed credit.

The blue line in Figure 6 shows that responses are very similar to the baseline estimates, with slightly dampened responses, when adding year fixed effects to the specification. This may, however, underestimate the link between foreign-financed household debt and macroeconomic outcomes, if increases in foreign-financed household credit are driven by global capital supply, as we will discuss later. We also exclude countries with large foreign sector positions (Iceland, Ireland, the Netherlands, Switzerland, United Kingdom) from the estimation sample (green). The specification in yellow excludes a three year window around financial crises from the sample. Both lines show, if anything, a strengthening in the relationship between household credit and subsequent economic

Figure 6: *GDP responses to changes in household credit by ultimate counterparty, robustness*



Notes: This figure shows different estimates of impulse responses of real GDP (in %) to increases in the ratio of total household credit to GDP (left panel). The three right panels show responses to increases in household credit decomposed by ultimate counterparty sector based on Equation 1. The black line corresponds to the baseline estimates reported in Figure 5. Dashed lines represent 95% confidence intervals around this estimate, based on standard errors dually clustered on country and year. Additional specifications include year fixed effects (blue), additional controls such as current account, household net position, foreign inflows not financing household credit (red), excluding financial center countries (green) and excluding three years around a financial crisis (yellow).

outcomes, being close to our baseline estimates. Figure A4.15 in the appendix shows the estimated responses relying on a SVAR-model instead of local projections. The responses look similar to our baseline estimates using this alternative empirical approach. All these tests confirm our main result: household credit funded from the RoTW is associated with an initial increase in output followed by a reversal that underlies the negative medium-term association between household credit expansion and output reported in Mian et al. (2017).

For the single-equation model, Table A4.4 in the appendix shows that these results are robust to the exclusion of countries with very large rest of the world positions. Table A4.5 shows that foreign-financed household credit expansion in a single variable model achieves an R^2 similar to a regression including all other variables. Table A4.6 shows that the results are robust when we use data from other unveiling procedures.

3.3. Heterogeneity across countries

We now explore heterogeneity in the relationship between credit and output to understand conditions under which these effects are particularly pronounced. This heterogeneity relates to features

of the economic system of a country such as exchange rate regimes, financial integration, and size.

Do exchange rate regimes matter? Column (1) in Table 2 shows full sample results from estimating Equation 2, including the current account. We then split the sample into subsamples of pegged and floating exchange rate regimes, where the pegged sample includes both fixed and intermediate regimes based on the classification in Ilzetzki et al. (2019).[15] This distinction is important, as the relationship between foreign-financed credit expansion and the business cycle, in theory, could be countered by monetary policy.[16] According to the open economy trilemma, the option of using monetary policy is only available to policymakers in floating exchange rate regimes. Without floating exchange rates, countries do not have this margin of adjustment and have to track policy rate changes in the respective base countries. Columns (2) and (3) in Table 2 show that the macroeconomic outcomes associated with credit expansion indeed depend on exchange rate regimes. The coefficient for foreign-financed household credit expansion is closer to zero and insignificant in a sample of floating rates economies (column 2), but negative and significant in economies without monetary autonomy (column 3). Figure A4.16 shows estimates from country level time series regressions, with coefficients for the majority of countries negative and significant. In line with the finding above, floating rate countries have coefficients closer to zero. However, with the exception of Australia, these coefficients are negative and some of them even statistically significant.

Is the relationship only driven by financial integration in the Euro-area? We now explore how the relationship is affected by the introduction of the Euro, where financial integration goes beyond an exchange rate peg. The common currency has been associated with higher volatility of capital flows among member countries (Kalemli-Ozcan et al., 2010; Fornaro, 2021). This can be

[15] In our sample, Australia, Japan and the United States are consistently classified as floating exchange rate regimes. Furthermore, Canada is classified as floating after 2002, Germany before 1998, and the United Kingdom after 2009.

[16] In Schmitt-Grohé and Uribe (2016) the negative consequences of credit expansions are triggered by hard-to-reverse reallocation dynamics during the boom that are associated with adverse outcomes when the credit cycle reverses. Such reallocation dynamics are identified by Mian et al. (2020) and Müller and Verner (2021). Table A4.7 shows similar results for foreign-financed household credit expansions in our data. However, there is no strong difference to domestically financed household credit expansions.

Table 2: *Heterogeneity in GDP responses to increases in household credit by financing counterparty*

	$\Delta_3 ln(Y)_{i,t+3}$						
		Exchange Regime				Country Size	
Sample:	Full	Float	Peg	Euro	Peg∉Euro	Small	Large
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$\Delta_3 RoTW \rightarrow HH_{i,t-1}$	-0.87***	-0.13	-1.00***	-1.23***	-0.73***	-0.97***	-0.61**
	(0.19)	(0.34)	(0.18)	(0.24)	(0.17)	(0.21)	(0.15)
$\Delta_3 HH \rightarrow HH_{i,t-1}$	0.18	0.22	0.06	0.29	-0.16	0.13	0.28
	(0.17)	(0.21)	(0.26)	(0.43)	(0.23)	(0.26)	(0.22)
$\Delta_3 GG \rightarrow HH_{i,t-1}$	-0.39	-0.76	-0.33	-0.64	-0.25	-0.35	-0.64
	(0.30)	(0.57)	(0.35)	(0.97)	(0.31)	(0.34)	(0.58)
$\Delta_3 CA_{i,t-1}$	0.24**	0.55	0.20*	0.69**	0.10	0.18	0.82**
	(0.12)	(0.43)	(0.11)	(0.29)	(0.11)	(0.12)	(0.24)
R^2	0.361	0.362	0.405	0.449	0.421	0.378	0.375
Country fixed effects	✓	✓	✓	✓	✓	✓	✓
LDV	✓	✓	✓	✓	✓	✓	✓
NF Credit	✓	✓	✓	✓	✓	✓	✓
Mean (in %): $\Delta_3 RoTW \rightarrow HH_{i,t-1}$	2.99	1.75	3.3	4.25	2.59	3.31	2.01
SD (in %): $\Delta_3 RoTW \rightarrow HH_{i,t-1}$	5.53	3.4	5.9	6.36	5.46	5.89	4.12
Observations	667	132	534	233	291	501	166

Notes: This table presents results from estimating Equation 2 over different samples. The dependent variables is the growth of real GDP between year t and $t+3$. Household credit is decomposed by ultimate counterparty sector. Credit variables are expressed as lagged three-year changes in the ratio to GDP. LDV are distributed lags of the dependent variable. NF Credit includes non-financial credit decomposed by ultimate counterparty sector. Standard errors in parentheses are dually clustered on country and year. *,**,*** indicates significance at the 0.1, 0.05, 0.01 levels, respectively.

seen comparing mean and standard deviation of $\Delta_3 RoTW \rightarrow HH$ at the bottom of Table 2, when we split observations with an exchange rate peg into Euro and non-Euro pegs in columns (4) and (5). Compared to floating rate countries, but also compared to pegs without a currency union, foreign-financed household credit increased more in Euro-area countries, where it has also been more volatile. Moreover, the common currency is not only associated with higher growth and volatility in foreign funding of domestic credit, the relationship between credit and subsequent macroeconomic outcomes is also stronger in the monetary union. Nevertheless, the coefficient remains significantly negative a sample of non-Euro but pegged economies in column (5). While the mechanisms that link foreign-financed household credit to macroeconomic outcomes seem stronger in a monetary union, they are not limited to these observations.

Are these effects contingent on country size? We define the largest 5 economies in our sample, the United States, Japan, Germany, the United Kingdom, and France as large and the rest of our sample countries as small economies. This distinction is important, as it reflects the potential to finance credit domestically. A large economy, presumably, has more potential to source credit at

home, while it seems more likely for small economies to rely on foreign financing. This is reflected by the differences in mean and volatility of $\Delta_3 RoTW \rightarrow HH$ between large and small countries in (6) and (7). Our results indicate that the association between credit expansion and output, while felt in both, is indeed stronger in small countries, which are more exposed to the global credit cycle.

4. Sources of credit and financial fragility

Credit expansions have been shown to predict banking crises (Schularick and Taylor, 2012). Rapid inflows of capital from abroad and the transformation into private domestic credit are one potential channel, but empirical studies have had mixed success in linking capital inflows to credit booms and banking crisis events. One explanation is that the capital flow measures used, mostly based on the current account, do not necessarily reflect the transformation of foreign capital into domestic credit. The following section studies whether our new measure of credit decomposed by financing sector helps predict banking crisis events and whether it allows us to understand what happens to credit intermediation after banking crises.

4.1. Predicting banking crises

To formally study the pre-crisis dynamics of disaggregated credit relationships, we turn to the standard crisis prediction framework, and ask whether the financing counterparty of credit contains information about crisis risk that goes beyond the information contained in aggregate credit variables. Specifically, we estimate a probit model for a systemic financial crisis starting in country i in year t (based on the Laeven and Valencia (2012)-chronology that covers all our sample countries), denoted by the indicator variable $B_{i,t}$ conditional on lagged observables $X_{i,t-1}$

$$Pr[B_{i,t} = 1 | X_{i,t-1}] = \Phi(\beta X_{i,t-1}), \tag{3}$$

where $X_{i,t-1}$ includes the three-year changes in credit relative to GDP, with credit disaggregated

by borrowing sector and financing source. β denotes the vector of coefficients of interest for the various specifications.

For comparison with counterparty estimates, column (1) in Table 3 reports mean marginal effects of changes in the ratio of total household credit to GDP between $t-4$ and $t-1$ on crisis likelihood in year t. An increase in the ratio of household credit to GDP is associated with significantly higher crisis likelihood. Three-year changes in credit to non-financial corporates are also associated with significantly elevated financial crisis risk (as recently argued in Greenwood et al., 2022 and Müller and Verner, 2021). As a measure of net capital inflows commonly used in the literature, we include the three-year change in the current account. The coefficient is negative, but insignificant as found in previous studies.[17] For all specifications, we report the AUC-statistic (*area under the curve*), which is a benchmark-summary of predictive accuracy which allows for the evaluation of predictive performance across specifications. The AUC-statistic is 0.5 for a model that does not add any predictive accuracy (a coin toss), and it approaches 1 for models that are perfectly able to sort the data into crisis and no-crisis bins. The benchmark model in (1) including three-year changes in household and firm credit as well as three-year changes in the current account has an AUC of 0.74, a significant improvement relative to the 0.5 random AUC. Column (2) additionally includes country fixed effects. The number of observations is decreasing since some countries did not experience a financial crisis in the sample period. Furthermore, the AUC is slightly higher, as fixed effects add some ability to sort the data into the crisis and no-crisis bins.

We then decompose credit by ultimate counterparty sector in column (3). The results suggest that the baseline relationship between expansions in household credit and crisis is driven by the component of household credit financed by foreigners. A one standard deviation (6.2 percentage points) increase in the ratio of household credit funded by foreigners is associated with a 3 ($= 6.2 \times 0.47$) percentage points higher likelihood of crisis. Given a sample frequency of about 3.5%, crisis risk almost doubles. Three-year changes in all other credit variables, as well as the current

[17] Including three-year accumulated current account levels instead of changes does not affect these results.

Table 3: *Predicting banking crises*

	Benchmark		By counterparty		Only RoTW to HH		All others	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\Delta_3 HH_{i,t-1}$	0.24***	0.46***						
	(0.07)	(0.18)						
$\Delta_3 NF_{i,t-1}$	0.04**	0.14*						
	(0.01)	(0.08)						
$\Delta_3 RoTW \rightarrow HH_{i,t-1}$			0.47***	1.15***	0.44***	1.23***		
			(0.11)	(0.27)	(0.08)	(0.26)		
$\Delta_3 GG \rightarrow HH_{i,t-1}$			-0.36	-0.37			-0.09	0.05
			(0.35)	(0.57)			(0.33)	(0.52)
$\Delta_3 HH \rightarrow HH_{i,t-1}$			-0.05	-0.09			0.06	0.08
			(0.23)	(0.40)			(0.26)	(0.39)
$\Delta_3 RoTW \rightarrow NF_{i,t-1}$			-0.04	0.06			0.06**	0.32**
			(0.04)	(0.10)			(0.03)	(0.14)
$\Delta_3 GG \rightarrow NF_{i,t-1}$			0.16	-0.04			-0.21	-0.82
			(0.40)	(0.75)			(0.35)	(0.72)
$\Delta_3 HH \rightarrow NF_{i,t-1}$			0.07	0.20			0.05	0.13
			(0.13)	(0.20)			(0.16)	(0.27)
$\Delta_3 CA_{i,t-1}$	-0.16	-0.26	-0.15	-0.21			-0.30*	-0.60*
	(0.16)	(0.34)	(0.17)	(0.36)			(0.18)	(0.32)
AUC	0.74	0.77	0.80	0.84	0.80	0.83	0.74	0.78
s.e.	0.05	0.05	0.05	0.04	0.05	0.04	0.05	0.05
Country fixed effects		✓		✓		✓		✓
Observations	739	534	739	534	739	534	739	534

Notes: The table shows probit classification models where the dependent variable is a banking crisis dummy based on Laeven and Valencia (2012). Coefficients shown are mean marginal effects. AUC is the area under the ROC-curve and below is its standard error. Columns (1) and (2) show results including three-year changes in total household and non-financial credit as a benchmark. In columns (3) and (4) credit variables are decomposed by ultimate counterparty. Columns (5) and (6) only include RoTW-financed household credit and (7) and (8) all other variables (excluding RoTW-financed household credit). Clustered (by country) standard errors in parentheses. *,**,*** indicates significance at the 0.1, 0.05, 0.01 levels, respectively.

account are insignificant. In terms of predictive accuracy this model performs significantly better than the model in (1) as indicated by the AUC of 0.80. The results in (4), including fixed effects, are very similar, also improving predictive accuracy relative to the model in (2).

Where are these improvements in predictive accuracy coming from? In column (5), we include only a single variable, the three-year change in household credit financed by foreigners. The coefficient remains similar to column (3), and more importantly, predictive accuracy is almost the same. A single-factor model, including only household credit expansion financed by the rest of the world, contains almost the same amount of information on crisis likelihood as a model additionally including changes in household credit financed from other sectors, non-financial credit decomposed by source, and the current account. To further illustrate this point, column (7) shows results from

a model excluding only three-year changes in household credit funded by the RoTW from the specification in (3) and the AUC drops to 0.75. We conclude that RoTW-financed household credit expansion contains information on crisis likelihood not contained in other credit measures. The coefficient estimates of the current account and non-financial credit financed externally are slightly significant in (7). Hence, they seem to capture some of the information on foreign funded household credit, albeit very imperfectly (as indicated by the low AUC). These findings are robust to the inclusion of fixed effects in columns (6) and (8).

Robustness. The appendix contains several robustness checks to ensure that results are not driven by the choice of specification or variable definitions. In Table A5.8 we estimate a linear probability model with country fixed effects instead of a probit model. In Table A5.9, we employ the Baron et al. (2021) chronology for banking crises and panics. In all these specifications, household credit funded by the rest of the world is highly significant and the most important link between credit and crisis, as indicated by the AUC across models.

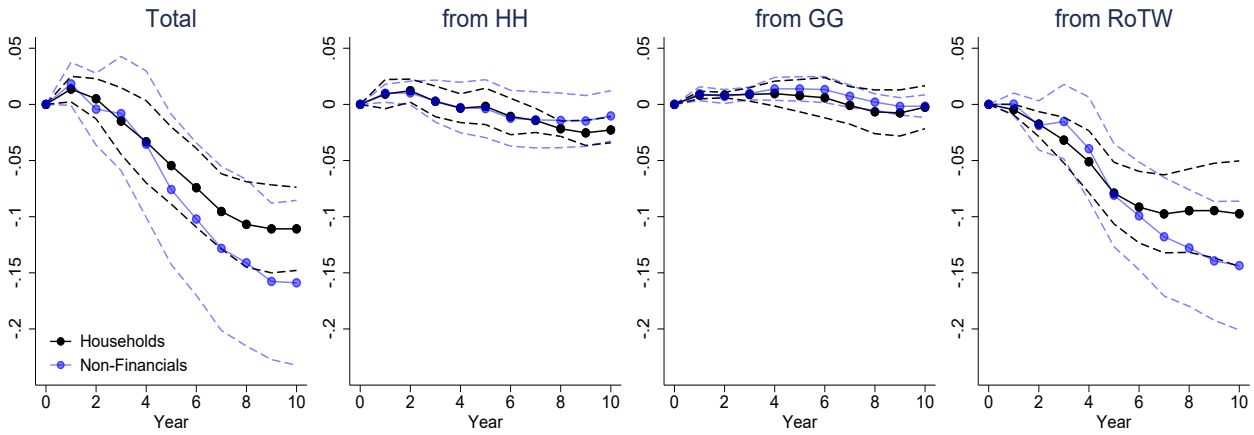
4.2. Sources of deleveraging after crises

Banking crises are often characterized by increases in the price of credit (Krishnamurthy and Muir, 2017; Romer and Romer, 2017) and disintermediation (Jordà et al., 2013). Here we ask, whether this disintermediation is specific to foreign-financed credit, since gross capital flows are known to dry up during periods of financial turmoil (Broner et al., 2013). Using our decomposition of credit by source of financing, we run local projections of the form

$$\Delta_h C^u_{i,t+h} = \alpha_{i,h} + \sum_{j=0}^{5} \beta^{BC}_{h,j} Crisis_{i,t-j} + \sum_{j=0}^{5} \beta^{u}_{h,j} \Delta C^u_{i,t-j} + \sum_{j=0}^{5} \beta^{y}_{h,j} \Delta Y_{i,t-j} + \epsilon_{i,t+h}, \tag{4}$$

where dependent variables $\Delta_h C^u_{i,t+h}$ are changes in the ratio of different measures of credit relative to GDP in country i between time t and time $t+h$. $\beta^{BC}_{h,0}$-coefficients measure the response of the respective credit measure towards a crisis event over varying horizons h. The results are plotted in

Figure 7: *Change in credit after crises by borrowing and ultimate counterparty sectors*



Notes: This figure shows estimates of responses of household credit (black) and non-financial credit (blue) to a financial crisis based on Equation 4. The left panel shows total credit for comparison, the three right panels divide credit by ultimate counterparty sector. Dashed lines represent 95% confidence intervals computed based on standard errors dually clustered by country and year.

Figure 7 and provide an account of financial intermediation after a banking crisis.

The left panel shows the response of total credit to households and to the non-financial sector to a banking crisis. Following a crisis, loans to the household sector, relative to GDP, slightly increase in the first year, before they start declining in the following years. Ten years after a crisis the ratio of household credit to GDP, on average, decreased by ten percentage points, non-financial credit even more. In the three right-hand panels we repeat this exercise decomposing credit by counterparty sector. To allow comparisons, we plot all graphs on the same scale. The right panel reveals which financing sector is behind the decline in credit. The ten percentage point difference for household credit in the left panel is almost entirely explained by the decline in credit financed with funds from abroad. Credit financed by domestic sectors does not decline significantly. In fact, the ratio of government-financed credit to GDP is increasing in the first years after financial crises. These effects are, however, difficult to observe in the graph, as they are an order of magnitude smaller than the decline in credit financed by the foreign sector.

Taken together, foreign-financed household credit expansion emerges as a strong predictor of financial crises, driving the relationship between aggregate credit and crises. It is also this foreign funding that is most flighty in periods of distress. Hence, crises after credit expansions financed by

foreigners are associated with stronger deleveraging. This deleveraging again may have adverse effects on the real economy (see, e.g., Chodorow-Reich, 2014; Huber, 2018).

5. Why is foreign-financed household credit linked to macroeconomic dynamics?

How is foreign capital that finances domestic household credit expansions linked to macroeconomic dynamics? Is it just that foreign-financed household credit proxies for large credit booms and therefore moves most around boom- and bust cycles, or are there particular frictions associated with households indirectly borrowing from foreigners? In the following section we evaluate these two possibilities.

To distinguish between them, we first look at the largest household credit booms and study their association with macroeconomic outcomes depending on their main source of financing. In a second step, we consider channels where the financing counterparty matters. In models of small open economies, such as Schmitt-Grohé and Uribe (2016), low interest rates in international financial markets cause domestic credit booms financed from abroad and increase demand in the short run. However, this increases the exposure to reversals in international credit market conditions. Hence, we test whether a higher share of foreign financing is associated with a higher likelihood of credit market reversals, going beyond the set of crisis observations studied in the previous section. Recent evidence for the bond market suggests that foreign investors have a relatively high demand elasticity (Bretscher et al., 2022) and might therefore be more likely to quickly withdraw funding for credit to the household sector.

Furthermore, as argued in Drehmann et al. (2023), borrowing today comes with debt service payments in the future. When borrowing is financed by foreign counterparties, this implies that future debt service payments will flow to foreigners, reducing consumption of constrained households. Foreigners receiving these payments, on the other hand, are less likely to consume this income domestically. Consequently, we look at the dynamics of individual GDP components around foreign-financed credit expansions (focusing especially on consumption), and analyze the

Table 4: *Household credit booms and subsequent macroeconomic outcomes*

	$\Delta_3 ln(Y)_{i,t+3}$				$\Delta_3 Unemployment_{i,t+3}$			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$HH\ Boom_{i,t-1}$	-0.07***	-0.06**			0.02**	0.02**		
	(0.02)	(0.02)			(0.01)	(0.01)		
$RoTW \rightarrow HH\ Boom_{i,t-1}$			-0.10***	-0.08***			0.04***	0.03***
			(0.03)	(0.03)			(0.01)	(0.01)
$DM \rightarrow HH\ Boom_{i,t-1}$			-0.03	-0.02			0.01	0.00
			(0.02)	(0.02)			(0.01)	(0.01)
R^2	0.244	0.299	0.271	0.321	0.308	0.395	0.347	0.420
Country fixed effects	✓	✓	✓	✓	✓	✓	✓	✓
LDV	✓	✓	✓	✓	✓	✓	✓	✓
NF Boom		✓		✓		✓		✓
Additional Controls		✓		✓		✓		✓
p-value HH, $\beta_{DM} = \beta_{RoTW}$			0.01	0.03			0.00	0.01
Observations	667	667	667	667	623	623	623	623

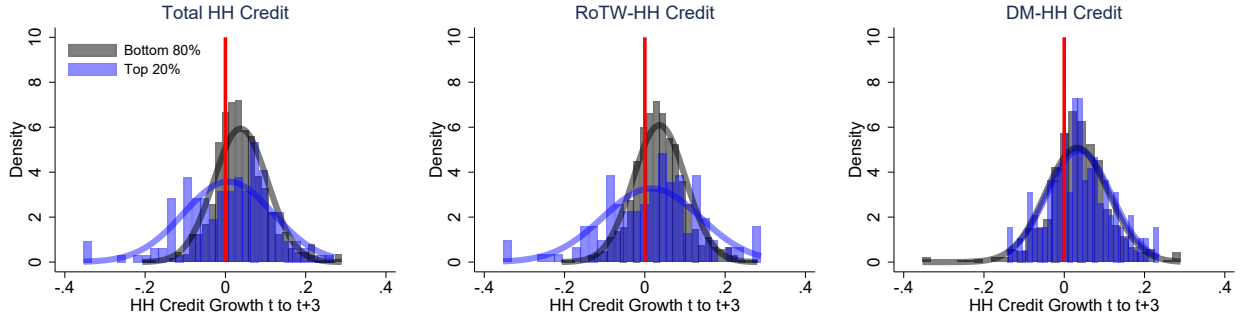
Notes: This table presents estimation results from a regression of the three year change in log real GDP (unemployment rate) on different classifications of credit booms. An episode is classified as a boom, if the increase in total credit (HH and NF) over the past three years has been above the 80th percentile of our regression sample. We then label booms with more than half of this increase financed from abroad as foreign-financed and others as domestically financed. Specifications control for identically defined booms in non-financial credit when indicated. LDV refers to a distributed lag of the dependent variable and the reported p-value to a test for the equality of the coefficients. Additional controls include changes in household sector financial net worth, foreign capital not financing household credit (relative to GDP) and the current account. Standard errors in parentheses are dually clustered on country and year. *,**,*** indicates significance at the 0.1, 0.05, 0.01 level, respectively.

role of debt service payments in these dynamics.

5.1. Booms and non-linearities

Are foreign-financed credit expansions just larger? It could be that foreign credit supply is more elastic than domestic financing, and, hence, contributes a disproportionate share of the financing during very large credit expansions. In this scenario, foreign-financed credit would simply be a proxy for the largest credit expansions which might be associated with negative macroeconomic outcomes. To evaluate this hypothesis, we follow Greenwood et al. (2022) and identify booms as periods where the three-year change in household credit to GDP is above the 80th percentile of the observations in our baseline specification in Table 1. For households this corresponds to the three year change in household credit to GDP being above 9.5%, for non-financial corporations above 11%. We then label booms with more than half of this increase financed from abroad as foreign-financed (84 out of 135 household credit boom observations). In the raw data, the average growth rate of real GDP over the three years following a foreign-financed boom is 0.1%, while it is 5.7% when a domestically financed household credit boom is detected, and 7.9% when

Figure 8: *Household credit expansion distributions, conditional on share of foreign financing*



Notes: This figure shows the distribution of household credit expansion over the period t to $t+3$. The distribution is shown for two groups of observations. We compare observations that were in the top quintile (top 20%) of total-, foreign- and domestic financed household credit in $t-1$ to all other observations, in the left, middle and right panel respectively. We overlay the respective normal distributions modeled on mean, standard deviation, and range. The distributions are winsorized at the 0.5 and 99.5% levels.

household credit expansion is below the boom threshold. Table 4 shows the negative link between household credit booms and GDP growth in columns (1) and (2), now using a boom dummy as the independent variable. Splitting booms by major source of financing in (3) shows that large household credit booms that are predominantly foreign-financed, are associated with 10% lower three-year GDP growth. While domestically financed household credit booms are also associated with slightly negative subsequent GDP growth, this effect is insignificant and, more importantly, significantly different from foreign financed booms. We find similar results when looking at changes in unemployment following large household credit expansions in columns (5) to (8).

Going beyond the largest credit expansions, Table A6.10 in the appendix studies potential non-linearities in a more general setting, including all our decomposed credit variables. Specifically we ask, if there is a difference between effects when credit expands ($\Delta_3 C^{u \to b} \geq 0$) compared to deleveraging ($\Delta_3 C^{u \to b} < 0$). These specifications show that the relationship between GDP and foreign-financed household credit is driven by increases, while decreases, just as any other credit variable, are unrelated to future GDP growth.

5.2. Reversals

To see how the exposure to credit cycle reversals depends on the counterparty financing credit, we plot in Figure 8 the distribution of future changes in household credit to GDP between t and $t+3$,

depending on outstanding household credit at $t-1$. In the left panel, we compare the observations with high household leverage (i.e. the ratio of household credit to GDP is in the top quintile) in blue to all other observations (grey). The graph shows that, when household leverage is high, the mean of future household credit expansion is shifted slightly to the left, but more importantly, that the dispersion is much higher, with significantly more mass on large household credit contractions. The middle graph shows the same pattern when we split our sample based on foreign-financed household credit to GDP: when foreign-financed household credit to GDP is high, dispersion of future household credit growth increases, and the likelihood of a reversal with large negative changes in household credit to GDP increases. When looking at domestically financed household credit in the right panel, we find no comparable pattern. Taken together, the results suggest that foreign financing of household credit is associated with a higher likelihood of household credit cycle reversals.

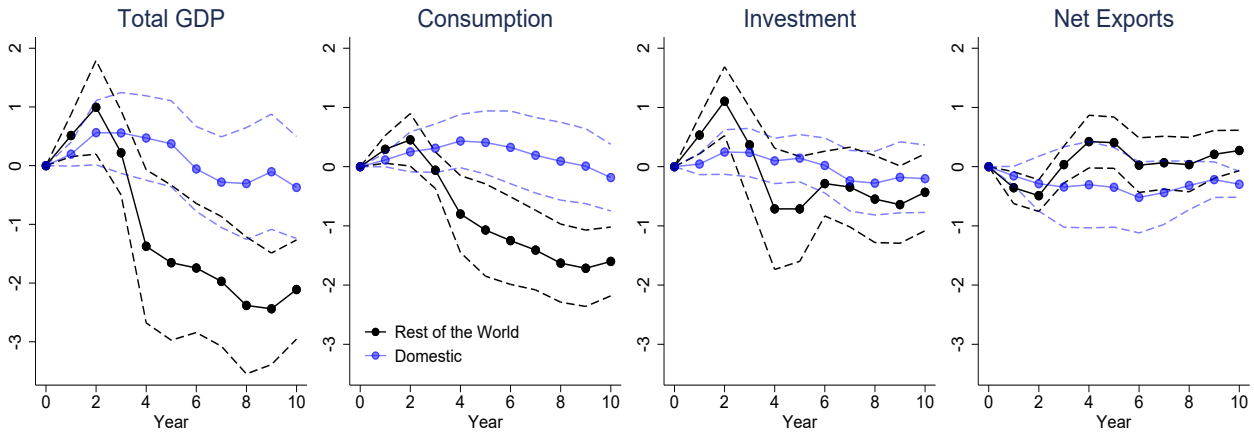
5.3. Decomposition of GDP responses

To better understand the channels linking credit and business cycles, we now decompose GDP into its components distinguishing between consumption (of governments and households), investment, and net exports. We estimate the responses of each of these components to different types of credit expansion separately, based on the following specification

$$\frac{y_{it+h}-y_{it}}{GDP_{it}} = \alpha_{i,h} + \sum_{b\in B}\sum_{u\in U}\sum_{j=0}^{5}\beta_{h,j}^{u,b}\Delta C_{i,t-j}^{u\to b} + \sum_{j=1}^{5}\beta_{j}^{y}\Delta y_{i,t-j} + \gamma X_{i,t} + \epsilon_{i,t+h}\,, \tag{5}$$

where the dependent variable is the change in the respective GDP component y between t and $t+h$ scaled by GDP at time t. Based on our previous results we distinguish between domestic and foreign counterparties ($u \in \{DM, RoTW\}$). We control for decomposed non-financial credit, lags of the dependent variable and changes in interest rates. In Figure 9 we show in blue responses to household credit expansion financed domestically (government and households) and in black

Figure 9: *GDP component responses to changes in foreign and domestically sourced household credit*



Notes: This figure shows estimates of impulse responses of real GDP components (in % of real GDP at $t = 0$) to increases in the ratio of household credit to GDP financed by the rest of the world (black) and domestic counterparties, i.e. domestic households and the government (blue). Impulse responses are estimated based on Equation 5. Dashed lines represent 95% confidence intervals computed based on standard errors dually clustered on country and year.

responses to household credit financed by foreigners. For comparison, the left panel shows the response of total GDP. The black line closely corresponds to the estimate in the right panel of Figure 5, while the blue line contains the response to increases in the sum of government- and household-financed household borrowing. The three right panels decompose the response of GDP into the responses of the individual GDP components. Since responses are normalized by GDP in year t they add up to the total response on the left (up to a small residual).

Starting with the largest component of GDP, the second panel shows that there is a significant difference in the response of domestic consumption to household credit financed from abroad and domestically financed household credit. Foreign-financed household credit expansion is associated with a small, short-lived consumption boom that is followed by a decline in household consumption in the medium term. For horizons longer than four years, consumption growth is significantly lower when foreign-financed household credit increases. This response of consumption contributes significantly to the response of total GDP in the left panel.

The middle right panel shows that the boom and bust pattern following foreign-financed household credit expansions also has an investment component. An increase in foreign-financed household credit is followed by a short-lived investment boom (slightly stronger than for consump-

tion). This boom lasts for two years, and reverses after year three.[18] For horizons larger than three years the response is close to zero and insignificant. The right panel shows that net exports decrease shortly, but reverse once the investment and consumption booms are over. These responses, in particular of consumption and investment, add up to create the patterns in total GDP shown in the left panel. Domestically-financed household credit expansion is, again, not associated with any of these dynamics.

5.4. The role of debt service payments

What explains the strong response of consumption to foreign-financed household credit expansion? As Drehmann et al. (2023) show, real reversals following household credit expansions are closely linked to debt-service payments implied by previous household borrowing. This is consistent with models that feature heterogeneity in marginal propensities to consume or financial constraints between borrowers and lenders (Korinek and Simsek, 2016; Farhi and Werning, 2016; Schmitt-Grohé and Uribe, 2016). In a closed economy context, Mian et al. (2021a) argue that debt service payments flow from borrower households with a high marginal propensity to consume to wealthy saver households with a low marginal propensity to consume, weighing on future aggregate demand. In open economies, credit can be financed by foreign counterparties, which will receive future debt service payments from domestic borrowers. These foreigners are likely to have an even lower marginal propensity to consume domestically, and thereby the debt service flow may lower future domestic demand.

To study this channel we look at household debt service payments flowing abroad. As argued in Mian et al. (2021b), the unveiling procedure not only assigns today's liabilities to a financing counterparty, but also contains information on the future flow of debt service and repayments. We compute household debt service payments flowing abroad, $Debt\ Service\ Ratio_{i,t}^{HH \to RoTW}$, using household sector debt-service-to-income ratios from the BIS debt service statistics (Drehmann et al.,

[18] This investment cycle, however, does not directly relate to the productive capacity of the non-financial sector. A large share of increasing investment is investment into dwellings as shown in Table A4.7.

2015) multiplied by the share of household credit ultimately financed from abroad[19]

$$DSR_{i,t}^{HH \to RoTW} = DSR_{i,t}^{HH} \times \frac{C_{i,t}^{RoTW \to HH}}{C_{i,t}^{HH}}. \tag{6}$$

Before turning to the relationship between debt service payments to different counterparties and aggregate dynamics, we confirm in Table A6.11 that this measure is increasing in foreign-financed household credit expansion. Since this relationship partly holds by construction, we additionally use data on "gross primary incomes payable to the rest of the world" as a share of GDP from national accounting data. This variable includes dividend and interest payments to foreign counterparties, capturing the payment streams associated with foreign financing of household credit.[20] Table A6.11 confirms that this measure is likewise increasing in foreign-financed household credit.[21] More broadly, this result also serves as an additional validation of our unveiling approach: it shows that payment flows from national account data line up well with our unveiling results.

We now study whether debt service payments flowing abroad, $DSR_{i,t}^{HH \to RoTW}$, weigh on future consumption and GDP growth similar to the specification for total household debt service in Drehmann et al. (2023). We additionally include debt service of households to domestic counterparties $DSR_{i,t}^{HH \to DM}$. The results in column (1) suggest a strong negative link between $DSR_{i,t}^{HH \to RoTW}$ and consumption growth over the following years. The coefficient on $DSR_{i,t}^{HH \to DM}$ is also negative and significant, but far from magnitude of the $DSR_{i,t}^{HH \to RoTW}$ coefficient, and a test for the equality of the two coefficients is rejected. These results are consistent with the channel highlighted above:

[19] Household credit in our data maps directly into the BIS statistics on domestic credit. Hence, this simple calculation provides a proxy for debt service payments to foreigners. It does not account for income of domestic intermediaries in the intermediation chain between households and foreigners, and it would over-/underestimate payments if there are systematic differences in interest rates/returns earned by foreign vs. domestic counterparties. As a simple sanity check, we confirm below that the measure calculated in Equation 6 is closely associated with income payments to foreigners from national accounting statistics.

[20] OECD classification code $D1\_D4NFRS2$. This variable also contains other payments associated with, e.g., compensation paid to foreign residents as well as reinvested earnings on FDI.

[21] We additionally report dynamic relationships in the left two panels of Figure A6.17 using local projections with changes in the DSR and in the ratio of primary income payments to the rest of the world relative to GDP as dependent variables. Both measures increase after foreign-financed household credit expansion. The binscatter in the rightmost panel of Figure A6.17 confirms that payment flows to the rest of the world are highly correlated with the computed $DSR_{i,t}^{HH \to RoTW}$.

Table 5: *Credit, debt service payments to foreigners, and economic activity*

	$\Delta_3 ln(Cons)_{i,t+3}$				$\Delta_3 ln(Y)_{i,t+3}$			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$DSR_{i,t}^{HH \to RoTW}$	-1.39***	-1.28***			-3.42***	-3.15***		
	(0.37)	(0.32)			(0.77)	(0.67)		
$DSR_{i,t}^{HH \to DM}$	-0.44*	-0.40**			-1.02*	-1.13**		
	(0.25)	(0.18)			(0.54)	(0.44)		
$Pay \to RoTW_{i,t}$			-0.38**	-0.34**			-0.97**	-0.89**
			(0.17)	(0.15)			(0.34)	(0.31)
$Net\ Pay \to RoTW_{i,t}$			0.22	0.30			0.24	0.35
			(0.32)	(0.33)			(0.64)	(0.68)
Country fixed effects	✓	✓	✓	✓	✓	✓	✓	✓
LDV	✓	✓	✓	✓	✓	✓	✓	✓
Credit Controls		✓		✓		✓		✓
Additional Controls		✓		✓		✓		✓
p-value, $\beta_{RoTW} = \beta_{DM}$	0.04	0.05			0.01	0.02		
p-value, $\beta_{RoTWPay} = \beta_{RoTWNet}$			0.11	0.11			0.07	0.09
Observations	248	248	248	248	248	248	248	248

Notes: The dependent variable in (1) to (4) is log real consumption growth from t to $t+3$ and log real GDP growth from (5) to (8). Independent variables are debt service ratios from households to foreign and domestic counterparties in (1), (2), (5) and (6). In (3), (4), (7), and (8) independent variables are gross payable incomes and net receivable incomes to and from foreigners. Debt service to foreigners and gross payable incomes to foreigners are shown to increase in foreign financed household credit expansion in Table A6.11. Additional controls include debt service of non-financial corporations, our baseline credit variables for household and non-financial credit growth between $t-4$ and $t-1$, the current account, inflows not financing household credit and changes in household sector net worth. All specifications control for country fixed effects and a distributed lag of GDP growth (LDV). The reported p-values refer to a test for the equality of the coefficients. Standard errors in parentheses are dually clustered on country and year. *,**,*** indicates significance at the 0.1, 0.05, 0.01 levels, respectively.

after borrowing from abroad, financially constrained domestic households have to reduce their spending to make debt service payments in the future. Foreigners receiving these payments have a lower marginal propensity to spend domestically, and hence aggregate domestic demand is depressed. This result holds controlling for lagged three-year changes in household and non-financial credit, the current account, household sector financial net worth, and other capital inflows in column (2).

As an additional variable capturing this channel, we again rely on gross primary incomes payable to the rest of the world variable as discussed above. Columns (3) and (4) show that this variable is strongly linked to negative future consumption growth. Domestic agents could also receive income on their foreign investments. Hence we additionally include the net income receivable from the rest of the world. While the coefficient for net income receivable from abroad has the expected direction, it is of smaller magnitude and statistically insignificant. One explanation could be that the domestic agents receiving payment flows from abroad are financially less constrained and have

a lower marginal propensity to consume out of this income. This finding reinforces the importance of studying these channels based on gross vs. net capital flow measures.

The same set of results holds when we employ GDP growth as a dependent variable in columns (5) to (8). Taken together, the findings suggest that there is an important international dimension of heterogeneity between borrowers and savers. While monetary policy could be employed to offset this channel, this option might not be available in fixed exchange rate regimes or close to the zero-lower bound.

6. Foreign credit supply vs. domestic credit demand

The previous sections have shown that the macroeconomic dynamics associated with household credit expansion differ based on the source of capital financing them, and that foreign financing is key to understanding the relationship between credit and business cycles. But why do foreigners finance domestic household credit? Rey (2013) argues that, empirically, it seems that capital flows are often unrelated to a country's macroeconomic conditions and instead driven by supply, often linked to a global financial cycle (see Miranda-Agrippino and Rey (2022) for a review). To study whether these supply-based explanations are associated with the dynamics we have presented here, we first need to disentangle the role of supply and demand for foreign-financed household credit. To do so we rely on the Amiti and Weinstein (2018) procedure to decompose bilateral banking flows into country-specific demand and foreign supply driven by country-specific and common supply shocks. In particular, we apply the Amiti and Weinstein (2018) procedure to data from the Locational Banking Statistics (LBS) provided by the Bank for International Settlements (BIS) similar to Amiti et al. (2019).[22] The LBS report the amount of bilateral outstanding claims of creditor banking system c on borrower country b, $L_{c,b,t}$. Using the Amiti et al. (2019)-approach we decompose the growth rate in these claims $\frac{L_{c,b,t}-L_{c,b,t-1}}{L_{c,b,t-1}}$ into country-specific time-varying demand

[22] Amiti et al. (2019) apply the procedure using the Consolidated Banking Statistics (CBS). However, the OECD non-consolidated financial accounts are based on the residency principle, as applied in the LBS and hence this data maps conceptually directly into our measure of foreign-financed credit. The claims reported in the LBS are reflected in the RoTW balance sheet in the financial accounts data.

($\alpha_{b,t}$) and supply effects ($\beta_{c,t}$)

$$\frac{L_{c,b,t} - L_{c,b,t-1}}{L_{c,b,t-1}} = \alpha_{b,t} + \beta_{c,t} + \epsilon_{c,b,t}. \tag{7}$$

Amiti and Weinstein (2018) show that estimating this equation using weighted least squares (WLS), with the lagged claim level as weights, allows to compute supply, demand, and common shocks that add up exactly to the growth rate of pre-existing relationships.[23] We implement their procedure in our data and decompose the growth rate in claims on borrower country b into idiosyncratic demand shocks $\hat{\alpha}_{b,t}$, a common shock $\hat{c}_t$ (the median bilateral growth rate at t), and the idiosyncratic supply shock, a weighted average of supply shocks of creditor banking systems $\sum_c \frac{L_{c,b,t-1}}{\sum_c L_{c,b,t-1}} \hat{\beta}_{c,t}$. As discussed by Amiti and Weinstein (2018), in this approach the underlying assumption is that capital supply is creditor-specific and demand for funds is borrower-specific.

Figure A7.18 shows the estimated growth decomposition for some of our sample countries, where we choose the set of countries such that the estimated shocks can be compared to the results presented in Figure 10 of Amiti et al. (2019).[24] We then add up the common and country-specific supply shocks to obtain a measure of banking inflow supply shocks that is orthogonal to country-specific demand factors by design. We transform the growth rates into volumes of funds and add up these volumes over the same three-year window that we use in our baseline regressions and likewise scale them by GDP. Figure A7.19 shows that there is a strong positive relationship between this foreign supply of funds and our measure of foreign-financed household credit expansion.

We then study the role of these supply shocks for the relationships documented in the previous sections. We fix the sample to observations where the supply variable is available and report our baseline OLS relationship between foreign-financed household credit and the business cycle in column (1) of Table 6. Column (2) shows the reduced-form relationship between the GDP-scaled

[23] See Amiti and Weinstein (2018) and Amiti et al. (2019) for the derivation. We implement the procedure using the AWshock.ado command for Stata.

[24] Their figure is based on the CBS data (compared to the LBS data here) and it also relies on adjustments that cannot be made in the public data. Nevertheless, the estimated series correspond closely to each other.

Table 6: *Foreign-financed household credit and business cycle dynamics - foreign supply of funds*

	$\Delta_3 ln(Y)_{i,t+3}$			$\Delta_3 Unemployment_{i,t+3}$		
	Baseline (1)	*Reduced* (2)	*IV* (3)	*Baseline* (4)	*Reduced* (5)	*IV* (6)
$\Delta_3 RoTW \rightarrow HH_{i,t-1}$	-0.83***		-1.90***	0.23***		0.27***
	(0.17)		(0.57)	(0.04)		(0.07)
$\Delta_3 Supply_{i,t-1}$		-0.25***			0.05***	
		(0.05)			(0.02)	
Country fixed effects	✓	✓	✓	✓	✓	✓
LDV	✓	✓	✓	✓	✓	✓
Credit Controls	✓	✓	✓	✓	✓	✓
Current Account	✓	✓	✓	✓	✓	✓
Kleibergen-Paap Weak ID	.	.	22.37	.	.	11.93
Observations	653	653	653	609	609	609

Notes: The dependent variable is real GDP growth from t to $t+3$ in (1)-(3) and changes in the unemployment rate between t and $t+3$ in (4)-(6). All specifications control for country fixed effects and distributed lags of the dependent variable (LDV). Credit controls include household credit financed by domestic sectors and non-financial credit. Columns (1) and (4) are based on Equation 2. Columns (2) and (5) replace $\Delta_3 RoTW \rightarrow HH_{i,t-1}$ with the supply shock measure. Columns (3) and (6) use the supply shock measure as an instrument for $\Delta_3 RoTW \rightarrow HH_{i,t-1}$. Standard errors in parentheses are dually clustered on country and year. *,**,*** indicates significance at the 0.1, 0.05, 0.01 level, respectively.

supply shocks and subsequent output dynamics. The coefficient is negative and highly significant. Supply-driven banking inflows are associated with business cycle slowdowns. Column (3) employs foreign supply as an instrumental variable for foreign-financed household credit growth. The second-stage coefficient is highly significant and larger than the baseline coefficient reported in column (1), suggesting that the baseline OLS estimates are biased towards zero. Such a bias seems plausible, as households may sometimes borrow from abroad against (expected) good future fundamentals. We report the Kleibergen-Paap statistic (22.37) which confirms the visual impression of a strong first-stage relationship from Figure A7.19. Columns (4) to (6) use changes in unemployment as the dependent variable. Again, the results using reduced form shocks and the instrumental variable specification are highly significant.

As in most macroeconomic applications, there are potential concerns we have to consider when interpreting instrumental variable results. One concern is that the common component entering the capital supply variable may be endogenous to expected global macroeconomic developments. In Table A7.12 we hence focus on small open economies excluding the five largest economies in our sample from the estimation. The remaining economies are exposed to the global financial cycle, but it is unlikely that the global cycle responds strongly to their expected macroeconomic

developments. We find that the results remain unchanged. One could also imagine times where investors across the globe want to invest in a particular country that acts as a safe haven. In that case the supply of capital from around the globe to that particular country may actually be reflected in the estimated country-specific demand term. Table A7.13 addresses that possibility by excluding the countries most likely associated with safe haven status, the U.S. and Germany, from the sample. Again, results are very similar to the ones reported for the full sample. Finally, supply shocks in foreign financing may affect the macroeconomy through other channels than foreign-financed household credit expansion. The most obvious candidate channel is foreign-financed credit to the non-financial sector expanding due to global capital supply. Empirically, however, Figure A7.19 shows that there is no clear relationship between international banking supply shocks and lending to non-financial corporates.

We can apply this approach also to the analysis of financial crises. In Table 7 we show results for probit models instrumenting foreign-financed household credit expansion. Column (1) shows, again, that foreign-financed household credit expansion predicts financial crises. In column (2), we include the foreign supply variable instead of foreign-financed household credit and find a significant relationship with subsequent crises. Column (3) contains the instrumental variable results and confirms the strong relationship between $\Delta_3 RoTW \rightarrow HH$ and financial crises. As for the business cycle relationships, the coefficient increases, suggesting a bias towards zero in the simple probit specification. Columns (4) to (6) confirm these results when including country fixed effects. These results suggest that supply-based increases in foreign-financing of household debt are associated with the macroeconomic developments that ultimately end in financial crises.

Expectations. Having established that foreign capital supply is associated with adverse macroeconomic outcomes, we ask whether these are expected at the time when foreigners fund domestic household credit? To answer this question, we follow the literature and look at economic growth forecasts and asset prices, which both contain information on expectations about the future (Mian et al., 2017; Baron and Xiong, 2017). We regress these measures on lagged household credit

Table 7: *Predicting financial crises - foreign supply of funds*

	Baseline (1)	*Reduced* (2)	*IV* (3)	*Baseline* (4)	*Reduced* (5)	*IV* (6)
$\Delta_3 RoTW \rightarrow HH_{i,t-1}$	0.44***		0.92***	1.13***		2.89***
	(0.09)		(0.29)	(0.24)		(0.51)
$\Delta_3 Supply_{i,t-1}$		0.18***			0.62***	
		(0.06)			(0.11)	
Credit Controls	✓	✓	✓	✓	✓	✓
Current Account	✓	✓	✓	✓	✓	✓
Country fixed effects				✓	✓	✓
Kleibergen-Paap Weak ID			25.55			14.97
Observations	725	725	725	523	523	523

Notes: The table shows probit classification models where the dependent variable is a financial crisis dummy. Coefficients shown are mean marginal effects. Baseline models are probit specification as in Equation 3. Reduced-form specifications replace $\Delta_3 RoTW \rightarrow HH_{i,t-1}$ with the supply shock measure. IV specifications use the supply shock measure as an instrument for $\Delta_3 RoTW \rightarrow HH_{i,t-1}$. Credit controls contain three-year changes in household credit financed by domestic sectors and non-financial credit, all relative to GDP. Clustered (by country) standard errors in parentheses. *,**,*** indicates significance at the 0.1, 0.05, 0.01 level, respectively.

expansion decomposed by financing source

$$y_{t+3} = \alpha_i + \sum_{u \in U} \beta^u \Delta_3 C_{i,t-1}^{u \rightarrow HH} + \gamma X_{i,t-1} + \epsilon_{i,t+3}, \tag{8}$$

where y_{t+3} refers to growth forecast errors ($e_{t+3|t}$) or cumulative asset returns ($R_{t \rightarrow t+3}$). The forecast error $e_{t+3|t}$ is computed as realized growth between t and $t+3$ minus the time t forecast of growth between t and $t+3$ produced by IMF staff. $X_{i,t-1}$ in this case contains non-financial credit and the current account. The results are presented in Table 8. Column (1) shows that this forecast error is significantly negative for foreign-financed household credit expansion. In other words, household credit financed by the rest of the world is associated with low output growth, but IMF staff economic forecasts do not account for this relationship. Domestically financed household credit or credit to the corporate non-financial sector are not associated with such forecast errors. This result holds when we instrument foreign-financed household credit with our supply measure in column (2).

Foreign investors, supplying capital for household credit expansions, do not necessarily share the same beliefs as IMF forecasters, so it is difficult to assess their private forecasts at the time of financing household sector borrowing. We can, however, assess whether periods of household

Table 8: *Credit expansion and expectations*

	$e_{t+3\|t}$		$R^{BankEquity}_{t\to t+3}$		$R^{HP\ Real}_{t\to t+3}$	
	OLS	*IV*	*OLS*	*IV*	*OLS*	*IV*
	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta_3 RoTW \to HH_{i,t-1}$	-23.28***	-40.20**	-5.13***	-15.41***	-1.25***	-1.66**
	(7.59)	(16.26)	(1.30)	(4.37)	(0.20)	(0.81)
$\Delta_3 GG \to HH_{i,t-1}$	0.61	2.45	-2.72	-1.65	-0.64	-0.62
	(4.79)	(4.98)	(2.52)	(2.97)	(0.54)	(0.54)
$\Delta_3 HH \to HH_{i,t-1}$	-5.59	-0.26	-1.16	0.28	-0.20	-0.09
	(3.72)	(8.40)	(1.57)	(2.01)	(0.38)	(0.45)
Country fixed effects	✓	✓	✓	✓	✓	✓
NF Credit	✓	✓	✓	✓	✓	✓
Current Account	✓	✓	✓	✓	✓	✓
p-value, $\beta_{RoTW} = \beta_{HH} = \beta_{GG}$	0.00	0.02	0.01	0.01	0.00	0.34
Kleibergen-Paap Weak ID		13.57		34.85		13.03
Observations	594	594	523	523	585	585

Notes: This table reports regression estimates of GDP growth forecast errors, returns on the bank index and changes in the real house price index between t to $t+3$ on changes in credit measures from $t-4$ to $t-1$. IV specifications use the supply shock measure as an instrumental variable for $\Delta_3 RoTW \to HH_{i,t-1}$. All specifications control for country fixed effects, non-financial credit and the current account. The reported p-value refers to a test for the equality of credit coefficients by different counterparty sector. Standard errors in parentheses are dually clustered on country and year. *,**,*** indicates significance at the 0.1, 0.05, 0.01 level, respectively.

borrowing financed by foreigners are associated with high aggregate sentiment, and hence low subsequent returns. In column (3) we use the cumulative real total return from t to $t+3$ on the bank index ($R^{BankEquity}_{i,t\to t+3}$) as our dependent variable. We find that household credit expansions financed by foreigners predict low subsequent returns on the bank index. Financial markets, just as economic forecasters, do not reflect the link between foreign-financed credit growth and subsequent macroeconomic and financial outcomes. Again, this result holds in the instrumental variable specification in column (4).

Since loans to the household sector mostly consist of mortgages, we finally ask whether foreign-financed household credit predicts developments in housing markets, regressing three-year changes in the real house price index ($R^{HP\ Real}_{i,t\to t+3}$) on measures of past credit expansion. Column (5) shows that foreign-financed household credit expansions are associated with a predictably negative effect on the subsequent growth of house prices over the following years. While this relation is significant for foreign financed household debt expansions, domestically financed credit is not significantly related to future growth in house prices. As before, these findings hold in an IV-specification in column (6).

7. Conclusions

Credit to the domestic household sector ultimately financed with capital inflows is associated with domestic boom and bust cycles. As witnessed in 2007/2008, the risks associated with the booms often manifest themselves in a costly crisis a few years down the road. Some of these relationships were previously documented separately for credit expansions and (less robustly) for capital flows, but this paper shows that they are strongest when the two measures both reflect the same underlying balance sheet linkages between domestic households and foreigners. The unveiling approach applied in this paper allows to reflect these exposures in one single variable – household credit ultimately financed by foreigners – that captures future funding risks and payment flows which turn out to be crucial for macroeconomic dynamics.

The changing nature of financial intermediation documented in this paper has important implications for macroeconomic modeling and policy. Developments in domestic credit markets cannot be disentangled from global capital markets. Policymakers eager to avoid the adverse effects of rapid credit expansions have to account for the role of international capital in local credit cycles. For optimal policy, this may require to jointly assess the role of monetary and macroprudential policies as well as capital controls to insulate economies from these fluctuations.

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Online Appendix

Lukas Diebold and Björn Richter

When Two Become One: Foreign Capital and Household Credit Expansion

A. Online Appendix

A1. Data

Figure A1.1: *Financial accounts data from golden books, outstanding liabilities of financial institutions, Spain 1981-1988*

SPAIN TABLE 31B/06 *(cont'd)*

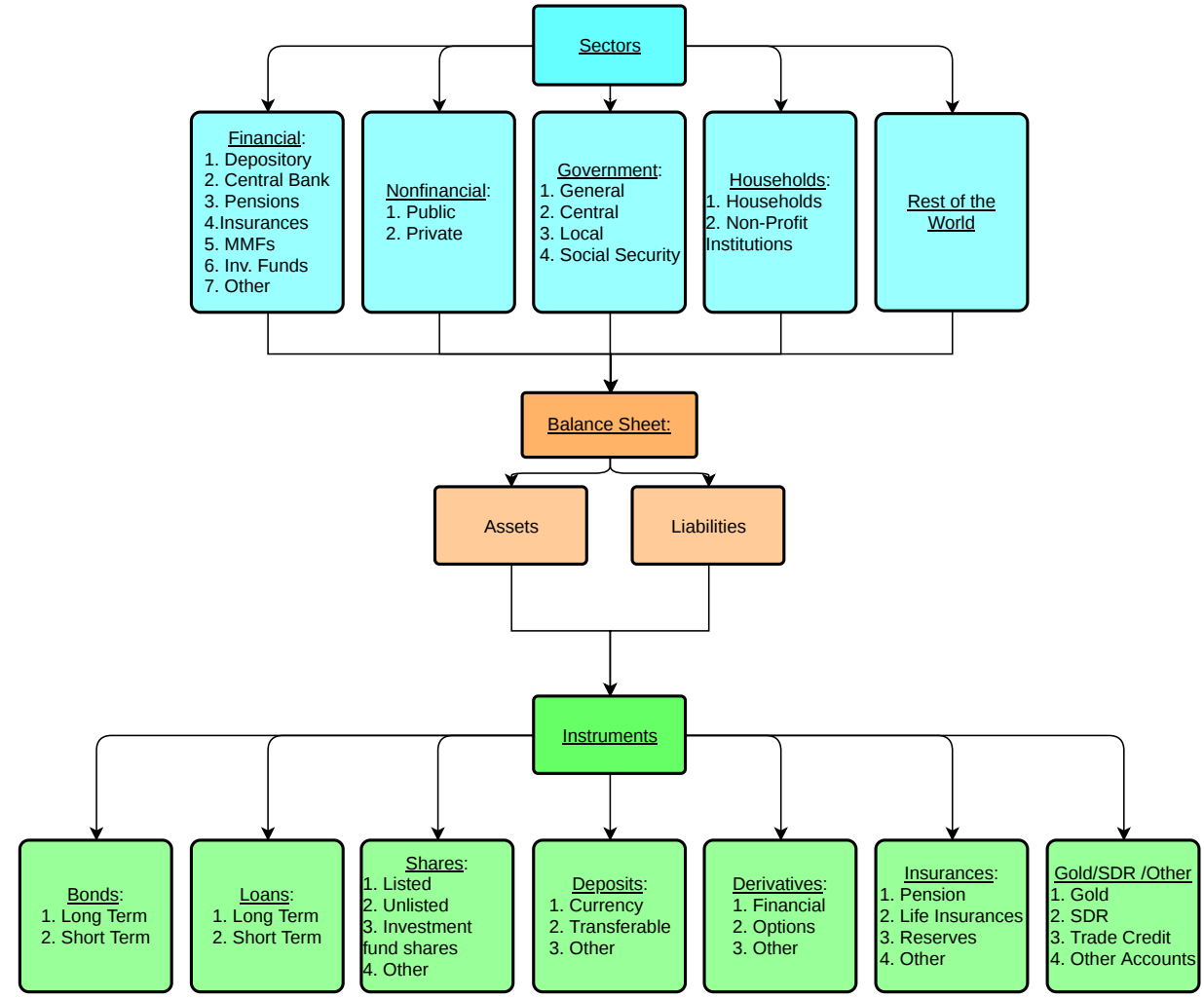
OUTSTANDING FINANCIAL ASSETS AND LIABILITIES OF FINANCIAL INSTITUTIONS

Monetary unit: billion pesetas

	1981	1982	1983	1984	1985	1986	1987	1988
LIABILITIES OF FINANCIAL INSTITUTIONS, to:	***26 895.6***	***32 763.5***	***39 246.4***	***46 446.7***	***51 446.0***	***57 266.6***	***66 446.5***	***76 083.8***
a) Institutions of the group	***2 065.2***	***2 850.5***	***3 163.3***	***4 031.4***	***5 060.6***	***5 163.8***	***5 193.8***	***6 129.6***
b) Other financial institutions	***3 033.4***	***4 334.6***	***6 365.3***	***7 363.6***	***7 842.3***	***9 057.1***	***11 372.3***	***13 544.0***
c) General Government	***1 697.9***	***2 240.9***	***2 676.3***	***3 157.7***	***3 432.8***	***3 553.1***	***3 692.9***	***2 629.9***
d) Other domestic sectors	***16 183.7***	***18 831.6***	***21 601.7***	***25 019.5***	***28 287.8***	***32 470.1***	***37 998.2***	***44 566.2***
e) Rest of the world	***2 893.5***	***3 054.7***	***3 482.8***	***4 138.1***	***3 679.1***	***3 897.1***	***4 254.9***	***5 072.8***
• Not allocated	***1 021.9***	***1 451.2***	***1 957.0***	***2 736.4***	***3 143.4***	***3 125.4***	***3 934.4***	***4 141.3***
1. Counterpart of net allocations of SDRs and use of IMF credit, ECUs	41.5	27.1	35.3	42.9	46.8	47.5	45.8	45.6
– Counterpart of net allocations of SDRs	*41.5*	*27.1*	*35.3*	*42.9*	*46.8*	*47.5*	*45.8*	*45.6*
2. Cash and other transferable deposits, *assets of:*	5 577.4	6 393.9	7 308.1	9 974.8	11 088.3	12 473.2	14 218.4	16 423.0
b) Other financial institutions	*822.0*	*1 025.3*	*1 340.1*	*3 441.0*	*3 733.8*	*4 089.3*	*4 598.1*	*4 676.8*
c) General Government	*196.3*	*363.7*	*472.9*	*616.0*	*715.3*	*759.2*	*849.7*	*1 078.2*
d) Other domestic sectors	*4 558.1*	*5 003.0*	*5 401.3*	*5 802.2*	*6 511.9*	*7 306.4*	*8 432.7*	*10 130.3*
e) Rest of the world	*1.0*	*1.9*	*93.8*	*115.6*	*127.3*	*318.3*	*337.9*	*537.7*
3. Other deposits, *by:*	15 114.4	18 105.9	20 958.8	24 979.7	27 433.2	29 607.5	34 740.6	39 927.6
a) Institutions of the group	*1 766.1*	*2 455.4*	*2 744.9*	*3 540.1*	*4 555.8*	*4 640.0*	*4 670.9*	*5 385.6*
b) Other financial institutions	*617.4*	*869.8*	*1 206.6*	*1 360.0*	*1 465.6*	*1 835.5*	*3 596.6*	*4 980.9*
c) General Government	*42.6*	*149.2*	*181.7*	*242.2*	*231.1*	*206.8*	*196.5*	*280.4*
d) Other domestic sectors	*10 039.7*	*11 889.2*	*13 829.9*	*16 167.2*	*17 980.9*	*19 802.4*	*22 933.1*	*25 510.5*
e) Rest of the world	*2 648.6*	*2 742.3*	*2 995.7*	*3 670.2*	*3 199.8*	*3 122.8*	*3 343.5*	*3 770.2*
4. Short-term securities, *held by:*	566.3	978.4	1 854.4	–	–	–	–	–
b) Other financial institutions	*566.3*	*978.4*	*1 854.4*	–	–	–	–	–
7. Bonds, *held by:*	479.9	683.6	936.0	1 328.9	1 716.2	2 228.8	2 054.5	2 114.3
a) Institutions of the group	*110.0*	*113.8*	*84.7*	*77.0*	*53.6*	*66.3*	*45.6*	*52.2*
b) Other financial institutions	*83.7*	*111.2*	*121.9*	*173.7*	*237.5*	*298.7*	*347.9*	*467.6*
c) General Government	*0.1*	*0.6*	*0.6*	*0.7*	*0.7*	*0.8*	*0.8*	*0.9*
d) Other domestic sectors	*285.5*	*457.7*	*728.7*	*1 076.8*	*1 424.4*	*1 863.0*	*1 647.6*	*1 579.4*
e) Rest of the world	*0.6*	*0.3*	*0.1*	*0.7*	–	–	*12.6*	*14.2*
8. Shares, *held by:*	1 070.0	1 162.3	1 241.2	1 493.7	1 764.4	2 566.6	3 569.9	5 295.2
a) Institutions of the group	*87.8*	*124.9*	*136.0*	*146.5*	*171.8*	*173.8*	*221.2*	*454.5*
b) Other financial institutions	*66.1*	*66.1*	*68.2*	*72.7*	*89.6*	*163.1*	*219.9*	*371.0*
c) General Government	*30.8*	*33.6*	*44.4*	*44.4*	*48.9*	*48.9*	*48.9*	*160.2*
d) Other domestic sectors	*834.6*	*879.5*	*917.2*	*1 142.3*	*1 332.9*	*1 925.1*	*2 727.1*	*3 833.6*
e) Rest of the world	*50.7*	*58.2*	*75.4*	*87.8*	*121.2*	*255.7*	*352.8*	*475.9*
5+9. Loans, *from:*	2 542.6	3 349.2	4 236.0	5 060.9	5 220.9	5 676.9	5 751.4	4 860.3
a) Institutions of the group	*73.1*	*125.1*	*166.3*	*227.6*	*229.8*	*212.0*	*192.8*	*170.3*
b) Other financial institutions	*877.9*	*1 283.8*	*1 774.1*	*2 316.2*	*2 315.8*	*2 670.5*	*2 609.8*	*3 047.7*
c) General Government	*1 428.1*	*1 693.8*	*1 976.7*	*2 254.4*	*2 436.8*	*2 537.4*	*2 597.0*	*1 110.2*
d) Other domestic sectors	*12.4*	*21.6*	*36.4*	*41.8*	*54.5*	*104.2*	*189.5*	*302.9*
e) Rest of the world	*151.1*	*224.9*	*282.5*	*220.9*	*184.0*	*152.8*	*162.3*	*229.2*
10. Net equity of household on life insurance reserves and pension funds, *assets of:*	453.4	580.6	688.2	789.2	983.2	844.6	1 309.5	2 326.8
d) Other domestic sectors	*453.4*	*580.6*	*688.2*	*789.2*	*983.2*	*844.6*	*1 309.5*	*2 326.8*
11. Others, *to:*	1 050.1	1 482.5	1 988.4	2 776.6	3 193.0	3 821.5	4 756.4	5 091.0
a) Institutions of the group	*28.2*	*31.3*	*31.4*	*40.2*	*49.6*	*71.7*	*63.3*	*67.0*
d) Other domestic sectors	–	–	–	–	–	*624.4*	*758.7*	*882.7*
• Not allocated	*1 021.9*	*1 451.2*	*1 957.0*	*2 736.4*	*3 143.4*	*3 125.4*	*3 934.4*	*4 141.3*

Notes: This figure shows a typical snapshot of the data from 'Golden Books' newly digitized for this paper. In addition to reporting sectoral accounts by financial instrument, the Golden Books data often includes some counterparty information, i.e. the counterparty sector for an asset or liability position, as can be seen here for the example of Spain between 1981 and 1988.

Figure A1.2: *Structural overview of financial accounts balance sheets*



Notes: This figure gives an overview over the structural composition of our data. It shows, from top to bottom: 1.) the division into the five main sectors, with their respective subsectors, 2.) the split into asset and liability positions and 3.) in which financial instruments these positions are recorded.

Table A1.1: *Year range by country and dataset*

Country	SNA08	SNA93	Golden Books
Austria	1995-2018	1995-2012	
Belgium	1995-2018	1994-2013	1973-1996
Canada	1990-2019	1970-2014	1974-1996
Chile	2003-2018	2002-2015	
Colombia	2015-2018	1996-2015	
Czech Republic	1995-2018	1994-2012	
Denmark	1994-2018	1994-2013	
Estonia	1995-2018	1995-2012	
Finland	1995-2018	1995-2012	1980-1995
France	1995-2018	1995-2012	1977-1997
Germany	1995-2018	1991-2012	1973-1997
Greece	1995-2018	1995-2013	
Hungary	1990-2018	1989-2013	
Iceland	2003-2018	2003-2012	
Ireland	2001-2018	2001-2012	
Israel	2010-2017	2010-2012	
Italy	1995-2018	1995-2012	1979-1997
Japan	1994-2018	1980-2014	1973-1996
Korea	2008-2018	2002-2012	
Latvia	1995-2018		
Lithuania	1995-2018		
Netherlands	1995-2018	1990-2012	1987-1996
Norway	1995-2019	1995-2013	1981-1993
Poland	1995-2018	1995-2012	
Portugal	1995-2018	1995-2013	
Slovak Republic	1995-2018	1995-2012	
Slovenia	1995-2018	2001-2013	
Spain	1995-2018	1980-2012	1973-1996
Sweden	1995-2018	1995-2013	1980-1996
Switzerland	1999-2018	1999-2011	
United Kingdom	1995-2018	1987-2013	
United States	1960-2019	1960-2013	1955-1996

Notes: This table shows the data range for the three separate sources which we use to construct our final dataset. All three are based on non-consolidated financial accounts from the System of National Accounts published by the OECD. Since Australia does not provide non-consolidated data, we instead use consolidated data. For Australia, the SNA08 version covers the years 1989 to 2018 and the SNA93 version the years 1989-2013.

Table A1.2: *Banking crises in sample*

Country	Laeven, Valencia	Baron, Verner, Xiong
Australia		
Austria	2008	2008, 2011
Belgium	2008	2008, 2011
Canada		1982
Chile		
Colombia		
Czech Republic		
Denmark	2008	2008, 2011
Estonia		-
Finland	1991	1990
France	2008	2008
Germany	2008	2008
Greece	2008	2008, 2010
Hungary	2008	1995, 2008
Iceland	2008	2008
Ireland	2008	2007, 2010
Israel		
Italy	2008	1992, 2008, 2011, 2016
Japan	1997	1990, 1997, 2001
Korea		
Latvia	2008	-
Lithuania		-
Netherlands	2008	2008
Norway	1991	1987, 2008
Poland		-
Portugal	2008	2008, 2011, 2014
Slovak Republic	1998	-
Slovenia	2008	-
Spain	2008	2008, 2010
Sweden	1991, 2008	1991, 2008
Switzerland	2008	2008
United Kingdom	2007	1991, 2008
United States	1988, 2007	1984, 1990, 2007

This table gives an overview over the banking crises in our sample. Entries with "-" indicate that the respective country is not included in the source sample. Empty entries indicate no documented crises episodes during our sample period. The left column refers to the crisis-chronology of Laeven and Valencia (2012), the right column to the chronology from Baron et al. (2021).

A2. Unveiling Approaches

This section describes our unveiling methodologies, with different approaches relaxing or altering key assumptions of our baseline.

A2-1 Proportional Unveiling (Baseline)

Which counterparty sectors ultimately finance credit to households and firms? This section describes our baseline procedure to answer this question in greater detail. In line with Mian et al. (2021b), we assume that ultimate counterparty sectors (u) can be domestic households, the government or the rest of the world ($u \in \{HH, GG, RoTW\}$). Corporate sectors (c) that cannot be ultimate counterparties and have to be unveiled are non-financial and financial corporations ($c \in \{NF, FI\}$). We use information on sectoral asset and liability composition to allocate loans to the ultimate counterparties providing financing.

Step 1: Our proportional unveiling approach relies on the accounting axiom that every liability is another agent's asset. Given the previously described data structure, we know the liability composition of any given sector, while observing the asset composition of all other sectors. Without detailed counterparty information, we allocate liabilities proportionally to the sectoral distribution in holdings of this instrument on the asset side. For example, we allocate deposits, used by the financial sector to finance loans, to a counterparty sector based on the share this sector has in total deposits holdings in the economy (excluding the financial sector itself). When the household sector holds 70% of all deposits in the economy (excluding deposits held as financial intermediary assets), we assign 70% of the deposit liabilities of the financial sector to the household sector.

More generally, we want to measure the bilateral claims held by financing sector s against borrowing sector r through financial instrument i, denoted as $\omega_i^{s \to r}$, for each sectoral creditor (holder)-borrower (issuer) pair. This information is observable in counterparty data (for some instruments i), but it is generally not available in our large panel of countries.The key assumption

we make here is that for a given financial instrument the mix of financing sectors can be computed based on the proportional asset holdings of all other sectors in that instrument.[25] Using this assumption, we estimate claims in instrument i held by counterparty sector s against recipient sector r as

$$\widehat{\omega}_i^{s \to r} = \frac{A_{i,s}}{\sum_{s \neq r}^{S} A_{i,s}} L_{i,r}, \tag{9}$$

where $(r, s) \in \{HH, GG, RoTW, NF, FI\}$ are the borrowing and the supplying counterparty sectors, and i the instrument through which r has raised and s has provided financing. Instruments (i) can be deposits, bonds, loans, shares, insurances and pensions, gold and SDRs, derivatives and options, or other accounts. $A_{i,s}$ and $L_{i,r}$ are assets and liabilities of sectors s and r in instrument i respectively. We can then compute the sum over all financial instruments for directed sectoral pairs $\widehat{\omega}^{s \to r} = \sum_i^I \widehat{\omega}_i^{s \to r}$.

While in principle allowing all possible $s \to r$ relationships, we will set $\widehat{\omega}_i^{RoTW \to HH} = 0$. The reason is that households normally do not directly access international financial markets to borrow. Whenever we observe counterparty information in the data, $\omega_i^{RoTW \to HH}$ is zero or very small. Allowing this direct link based on proportionality would therefore likely overestimate the importance of foreign financing for household credit. While we think this is a reasonable restriction based on observable data, it is important to note that this approach, if anything, underestimates the rest of the world as a funding source for household debt expansions.

Intuitively, our approach will work best, when instruments are held predominantly by one sector. In our example above: if households are the only owner of deposits in the economy, we will allocate deposits correctly. It is therefore an advantage that asset and liability composition differ substantially across sectors. However, we will validate our results using two alternative approaches. First, if we observe $\omega_i^{s \to r}$ directly in the data, the allocation procedure becomes obsolete, allowing

[25] This assumption is also used in Vom Lehn and Winberry (2022) and by the BEA to construct sectoral capital-flows tables.

us to validate our baseline results for the part of the sample where this information is available. In a second exercise we compare our baseline to estimates where we using different assumptions in the computation of $\widehat{\omega}^{s\to r}$.

Step 2: We want to determine the ultimate counterparty of household and non-financial corporate credit, i.e. we want to estimate $C^{u\to b}$ with u being the ultimate supplying sector ($u \in \{HH, GG, RoTW\}$) and b the borrowing sector ($b \in \{HH, NF\}$). While we calculated the direct link above, we need to account for indirect links, which turn out to be very important in the data as most credit is intermediated. These indirect links can take two forms. First, borrowers and u-sectors could be linked via one intermediary, e.g. domestic households holding deposits of financial intermediaries which then lend to other households. Second, there could be more than one intermediation step: e.g., consumer loans to the household sector by the NF sector could be financed with loans from FIs.

To correctly assign credit to the ultimate counterparty, we first estimate the total holdings of u-sectors in intermediary corporate c-sectors ($c \in \{NF, FI\}$), as the sum of direct holdings in the respective c sector, calculated in Equation 9 and indirect holdings channeled through the other c-sector c'. The second part of Equation 10 computes the claims of sector u against sector c channeled through c' via instrument i. Adding up the direct and intermediated (indirect) holdings yields the total assets $\widehat{\Omega}_i^{u\to c}$ in the two intermediary sectors for our three final suppliers of capital:

$$\widehat{\Omega}_i^{u\to c} = \underbrace{\widehat{\omega}_i^{u\to c}}_{direct} + \underbrace{\frac{\widehat{\omega}^{u\to c'}}{\sum_u \widehat{\omega}^{u\to c'}} \widehat{\omega}_i^{c'\to c}}_{indirect}. \tag{10}$$

For loans to the corporate non-financial sector the unveiling ends with this step. For consistency with household credit we denote the special case of $\widehat{\Omega}_{Loans}^{u\to NF}$, identifying loans to the non-financial corporate sector financed by ultimate sector u, as $C^{u\to NF}$.

Step 3: To determine the final holders of household debt, one more step is neccessary, distributing credit from the two c-sectors to households between the three u-sectors. The total funds

supplied by sector u to the household sector are then calculated as the sum of indirect and direct claims on the household sector[26]

$$C^{u\to HH} = \sum_c \frac{\widehat{\Omega}^{u\to c}}{\sum_u \widehat{\Omega}^{u\to c}} \widehat{\omega}^{c\to HH} + \widehat{\omega}^{u\to HH}. \tag{11}$$

Note, that the liabilities of the household sector almost exclusively consist of loans, so that we do not use a subscript for $i = Loans$.

A2-2 Counterparty Unveiling

For robustness, we employ counterparty unveiling using three different sources of data: the historical 'Golden Books' published by the OECD, the 'who-to-whom' matrices of the ECB and data newly made available under the System of National Accounts 2008 (SNA08) provided by the OECD on its website. These data contain counterparty information, i.e. a breakdown of counterparty sectors for a given financial instrument (on the asset or liability side of the balance sheet). Such counterparty data is available for a subset of countries, time periods, and financial instruments. Counterparty data makes step 1 of our baseline procedure obsolete, since we observe $\omega_i^{s\to r}$ directly in the data and do not have to estimate it. There are two potential ways to obtain information about $\omega_i^{s\to r}$, where having information on one is sufficient. As an example, assume the domestic financial sector records loans on the asset side by counterparty sector. Even without the household sector reporting counterparties, we know which part of its liabilities was funded by the domestic financial sector through loans. Consequently, we can 'fill' this household counterparty with the information available in the data.

Counterparty information is often available only for a subset of the data, i.e. only for some of the reported sectors or financial instruments. In that case, for the remaining relationships, we can exploit the fact that bilateral claims that are observed in the data, must not be assigned to

[26] Note that the direct link $\widehat{\omega}^{u\to HH}$ only plays a role for government claims on the household sector as we have set $\widehat{\omega}_i^{RoTW\to HH} = 0$ and direct loans between households are not recorded in the financial accounts (and likely to be small), i.e. $\omega_{Loans}^{HH\to HH} = 0$.

another counterparty during the unveiling process. The assets held by sector s against r through instrument i, $\omega_i^{s\to r}$ cannot be part of the estimated assets of sector s against any other sector. Using this reasoning, any counterparty information improves the accuracy of the unveiling. To implement this, we subtract the amounts observed in counterparty relationships from the corresponding asset positions of the supplying sector s and the liability position of the receiving sector r.

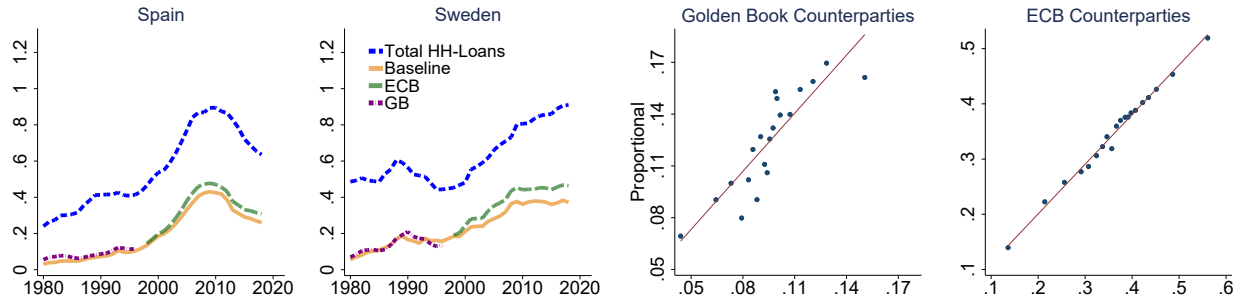
The remainders are allocated using equation Equation 9 to the remaining positions of other sectors with incomplete counterparty information. When counterparties are complete, this term will simply be zero. We can then use observable counterparty data $\omega_i^{s\to r}$ and pairwise holdings estimated from the unallocated assets and liabilities $\widehat{\omega}_i^{s\to r}$ and follow steps 2 and 3 in the unveiling approach.

The two left panels of Figure A2.3 quantify the results using the ECB 'who-to-whom'-matrices and the historical golden book data for Spain and Sweden respectively, showing foreign-financed household credit relative to GDP using the baseline approach and the results from the counterparty data approaches. In both cases. levels and dynamics are very similar using the baseline and the counterparty data approaches. If anything it seems like the baseline approach in yellow yields more conservative results, with counterparty data showing stronger increases around the 2008 crisis in both countries, and for the crisis in the early 1990s in Sweden. The binned scatterplots in the two right panels show a strong relationship between results using the different approaches in the full sample.

A2-3 Subsector Unveiling

Our baseline procedure treats the financial sector as a single entity, where it does not matter through which entity or subsector funds enter and leave the financial system. The data, however, sometimes includes additional breakdowns by subsector within the financial sector. Our subsector approach exploits this data by looking at the asset and liability composition of each financial subsector individually. We calculate the weighted average financing of every instrument on the asset side of

Figure A2.3: *Household debt financed by the rest of the world, proportional and counterparty unveiling*



Notes: The two left panels show the development of household debt financed by the rest of the world using different unveiling approaches. The short-dashed (blue) line corresponds to total outstanding household debt as a fraction of GDP for comparison. The solid (yellow) line is household debt ultimately financed by the rest of the world based on our baseline unveiling approach. The dotted (purple) line corresponds to an estimate using historical counterparty information. The dashed (green) line employs counterparty data from the ECB financial accounts. The two right panels compare the results using the baseline approach to results using counterparty information in historical OECD data. The right panel compares the baseline approach to results using ECB counterparty data. Observations are collapsed into 20 equal sized bins. Each point represents the group specific means of household credit financed by the rest of the world relative to GDP using the baseline and the respective counterparty approach after controlling for country fixed effects. Fitted regression lines illustrate the correlation.

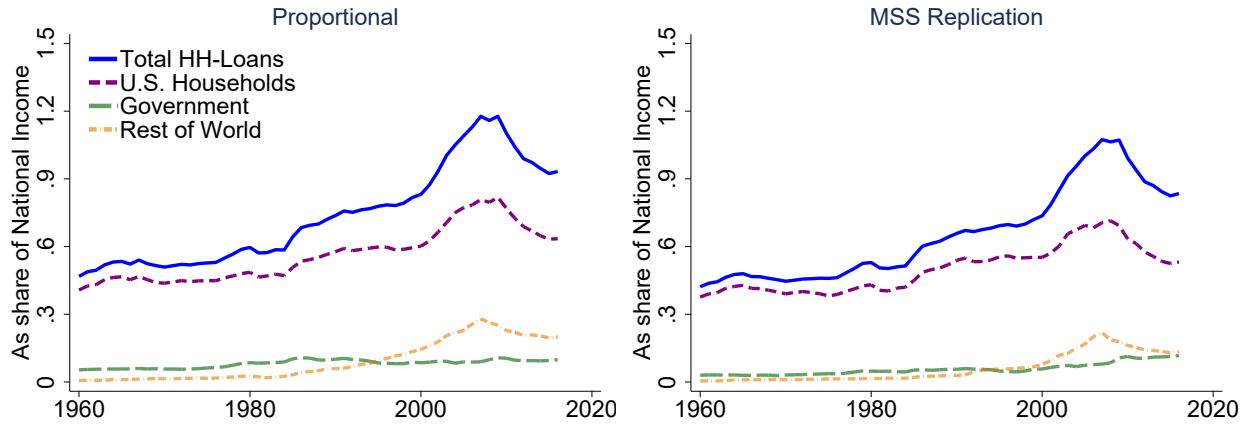
the total financial sector, given the financing structures of its subsectors. This means that the liability composition of the subsector that holds most loans, now matters most when assigning loans to ultimate holders. In doing so we assume, that funds are not channeled between financial subsectors, but exit the financial sector through the same subsector that raised them. The subsectors included in this approach are: Monetary Financial Institutions (MFI), Investment Funds (IF), Insurances and Pension Funds (IPF) and Other Financial Intermediaries (OFI). These four subsectors together add up to the total financial sector.

To unveil the ultimate holders of funds loaned out to households we start by calculating how much a subsector contributes to the assets of the total financial sector for any instrument i in Equation 12. We use this share as the weight a subsector has in holdings of a given instrument

$$\theta_{s,i} = \frac{A_{s,i}}{\sum_s^S A_{s,i}}, \tag{12}$$

with $\theta_{s,i}$ representing the share a subsector s holds in the total assets of the financial sector in instrument i. Included instruments are deposits, bonds, loans, shares, insurances and pensions, gold and SDRs, derivatives and options. To emphasize the difference between instruments on the asset and liability side of financial subsectors, instruments on the liability side are labeled j in the

Figure A2.4: *Comparison with Mian et al. (2021b)*



Notes The figure compares the result of our baseline unveiling procedure, using OECD data, to the unveiling methodology employed in Mian et al. (2021b), using US flow of funds data. Since we use total household credit, but Mian et al. (2021b) only mortgages, there are small level differences in the total (blue), which translate into level differences in household credit decomposed by ultimate counterparty. The proportionality and dynamics across graphs however are close to identical.

following equations. In Equation 13 we calculate the share that each instrument contributes to the total funding (i.e. the liabilities) of any subsector

$$\phi_{j,s} = \frac{L_{j,s}}{\sum_j^I L_{j,s}}. \tag{13}$$

$\phi_{j,s}$ now represents the share an instrument j contributes to the total liabilities of a financial subsector s. These two shares allow us to calculate the weighted average financing for each instrument on the asset side of the total financial sector:

$$\psi_{i,j} = \sum_s^S \theta_{s,i} \times \phi_{j,s}. \tag{14}$$

The left hand side $\psi_{i,j}$ now corresponds the share of instrument i on the asset side that is financed by instrument j. This captures the heterogeneity in financial sector balance sheets, as it is now possible for assets, e.g., loans to be financed by different liability compositions if they are held by different subsectors. These liabilities in turn might then be held by a different set of supplying sectors, leading to a potentially different allocation of household loans to ultimate suppliers of funds. Equation 15 first transforms instrument financing shares $\psi_{i,j,s}$ into nominal

values, by multiplying them with the total assets in instrument i by subsector s. Adding up these values over all subsectors delivers the amount of asset i being held by the entire financial sector financed with instrument j

$$\widehat{\Psi}_{i,j} = \psi_{i,j} \sum_{s}^{S} A_{s,i}. \tag{15}$$

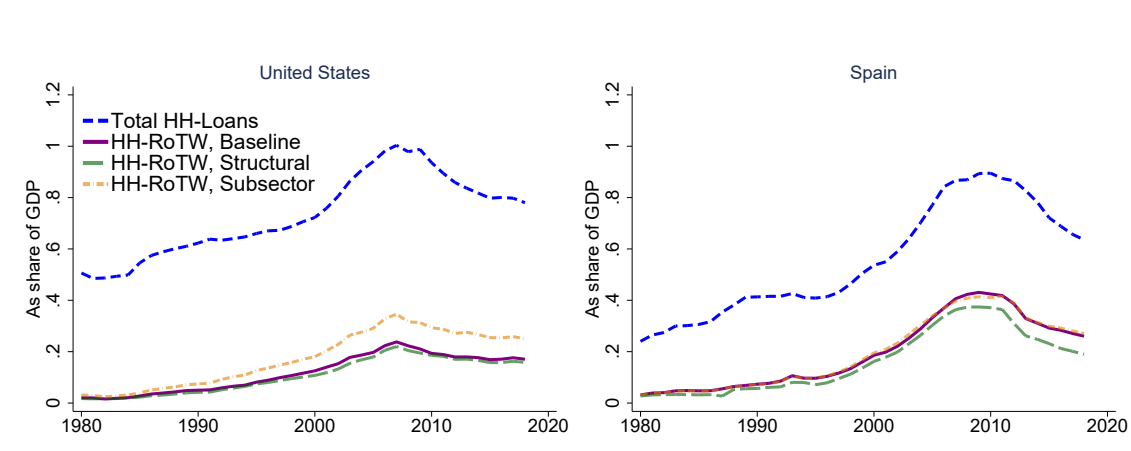
$\widehat{\Psi}_{i,j}$ consequently refers to the estimated nominal amount of instrument i on the asset side of the financial sector, that is financed by instrument j. From here on, we follow Equation 9 - Equation 11, with the deviation, that wherever the financial sector is concerned, we substitute $\widehat{\Psi}_{i,j}$ for $L_{FI,j}$ (the liabilities of the financial sector in instrument j are labelled with i in the baseline unveiling). Summing $\widehat{\Psi}_{i,j}$ over j yields the total assets of the financial sector in instrument i, while summing $\widehat{\Psi}_{i,j}$ over i gives the total liabilities of the financial sector in instrument j.

While the subsector unveiling marks the lower bound of financial intermediation, our baseline implicitly assumed that subsector-specific funding differences are irrelevant. It marks, in other words, the upper bound of financial intermediation within the financial sector. Figure A2.5 plots the results of the two approaches together. For the US, the subsector approach delivers a higher estimate for household credit ultimately financed by the foreign sector than our baseline, while for Spain and most other countries the two are almost identical. If anything, this confirms that our baseline is on the conservative end of the spectrum when estimating the importance of foreign credit to households. The left panel of Figure A2.6 quantifies the comparison between subsector and proportional unveiling, showing that on average differences are marginal.

A2-4 Structural unveiling: imposing the structure of US flow of funds

Mian et al. (2021b) use detailed data from US flow of funds to allocate household debt to ultimate holders. While we normally have less information in the panel data, we can impose the structure of the US financial accounts on other countries. In this approach, the financial sector is divided

Figure A2.5: *Alternative unveiling approaches*



Notes This figure shows total household debt and household debt ultimately financed by the foreign sector using three unveiling approaches. The dashed blue line is total household debt relative to GDP. The solid purple line is the share of household debt ultimately financed by the rest of the world, estimated with our baseline approach. The long-dashed green line presents results using the allowed sectoral allocations from Mian et al. (2021b) for unveiling. The yellow (short-dashed) line corresponds to the estimate using the subsectoral unveiling approach. See text.

into depository corporations, pensions, insurances, mutual funds, central banks and other financial institutions or pass throughs. The structure changes the assumption of proportional allocation of funds to a hierarchy in which each sector has bilateral relations with only a limited number of other sectors.

In later stages of the unveiling process, any sector s that is not one of the three final sectors (HH, GG, RoTW), will be unveiled itself. In this case the total household debt accumulated by s up to that point is summed and divided between the sectors that are permitted to hold assets in s. Finally, the household debt accumulated by the three ultimate sectors $u \in \{HH, GG, RoTW\}$, i.e. the ones that are not themselves divided between other sectors, is summed up over the allocations made in all different stages. Table A2.3 shows the seven stages of the unveiling with r being the sector being unveiled at a given stage and s being the sectors between which it is distributed.

Table A2.3: *Structural Unveiling Steps*

Stage	r (Receiving- \ Sector being unveiled)	s (permitted supplying sectors)
1	Total Household Debt	Government, Other financial Institutions (Pass-throughs), Depository Corporations
2	Other financial Institutions (Pass-throughs)	Rest of the world, Government, Insurances and Pensions, Central Bank, Money Market Funds, Investment Funds, Depository Corporations, Households
3	Central Bank	Rest of the world, Government, Depository Corporations
4	Money Market funds, Investment Funds	Rest of the world, Government, Insurances and Pensions, Households
5	Depository Corporations	Rest of the world, Government, Insurances and Pensions, Non-financial Institutions, Households
6	Non-financial Institutions	Rest of the world, Government, Insurances and Pensions, Households
7	Insurances and Pensions	Rest of the world, Government, Households

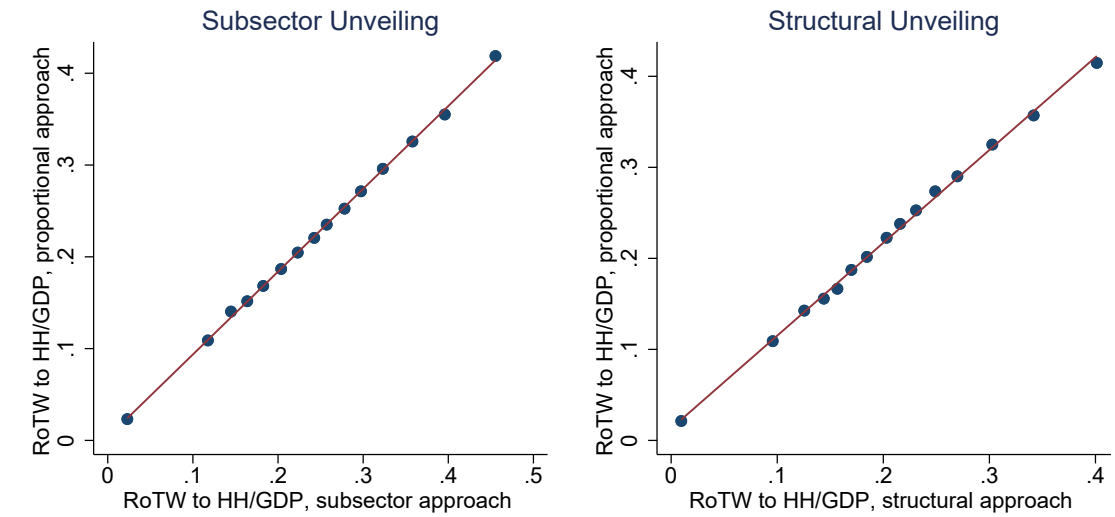
Figure A2.5 shows in blue total household debt, in green our estimate imposing the structure described above, in purple our proportional baseline and in yellow the results from subsector unveiling, for the United States and Spain. The difference between proportional and structural unveiling is virtually indistinguishable for the US. This is unsurprising, given that the structure was derived from the US financial sector. For Spain, the results differ marginally, hinting at homogeneous, if not identical structures in advanced OECD economies. The right panel of Figure A2.6 shows this result for all instances where unveiling imposing this structure is possible. Again, differences are marginal on average.

A2-5 Additional OECD Data: Counterparty and Consolidated

For further verification we replicate our results using the consolidated data series from the OECD System of National Accounts 2008 (SNA08). Using our proportional unveiling with consolidated data, we plot the results against our baseline with non-consolidated data in Figure A2.7, showing that the results are almost identical across datasets. This is quantified in the left panel of Figure A2.8.

The OECD has also made available a new counterparty dataset under the SNA08 format, but so far, only data for a few countries is available. We employ our previously described counterparty

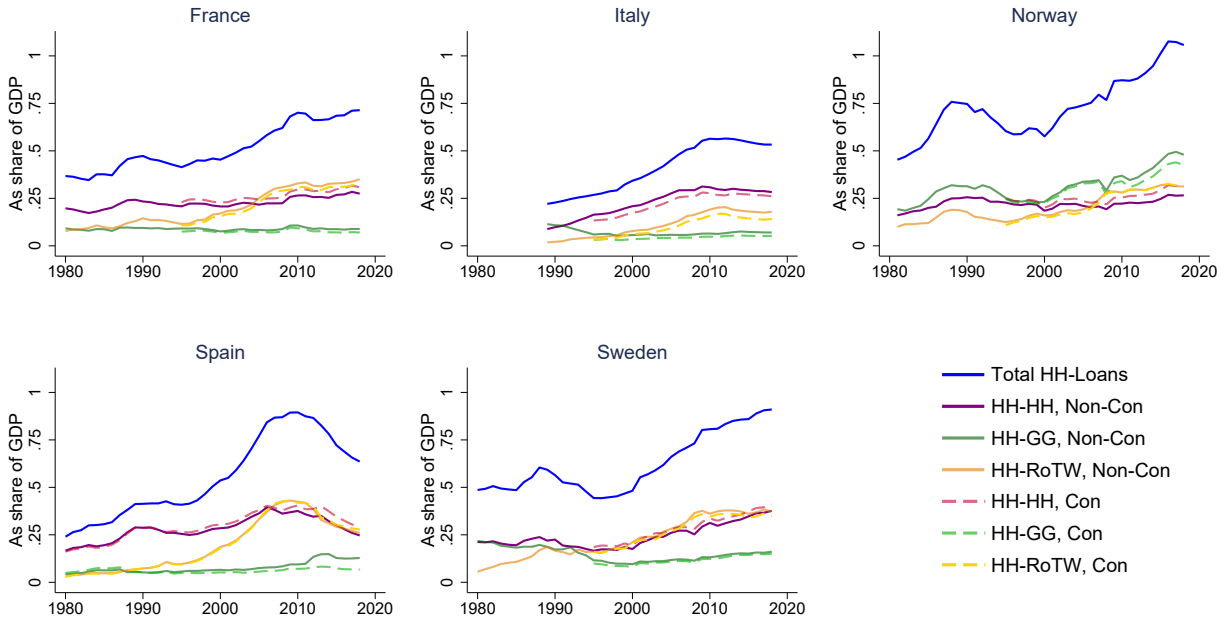
Figure A2.6: *Proportional compared to subsector and structural unveiling*



The figure shows the relationship between estimates of household credit funded by the foreign sector using different unveiling approaches. The left panel compares the results using the proportional approach to results using detailed subsector information in recent OECD data. The right panel compares our baseline to results using the structural approach derived from Mian et al. (2021b). Bins are constructed as in Figure A2.3.

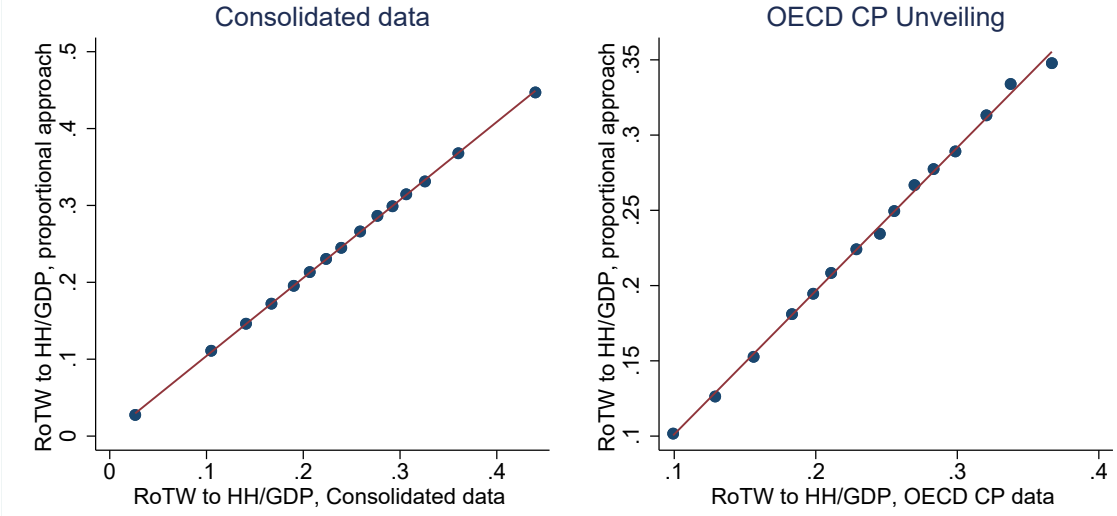
unveiling on this subset of countries and plot them against our baseline in the right panel of Figure A2.8. While the results again confirm our baseline results, this figure is not representative for the majority of our data, as the required information is only available for a very small subset.

Figure A2.7: *Household debt financing sources, non-consolodiated and consolidated data*



Notes: The figure compares sectoral sources of household debt for a number of countries using OECD data and the baseline unveiling approach. The solid lines represent the non-consolidated data used throughout our analysis. The dashed lines represent consolidated data from the same source. Since historical sources report non-consolidated data, the consolidated series generally start at a later point in time.

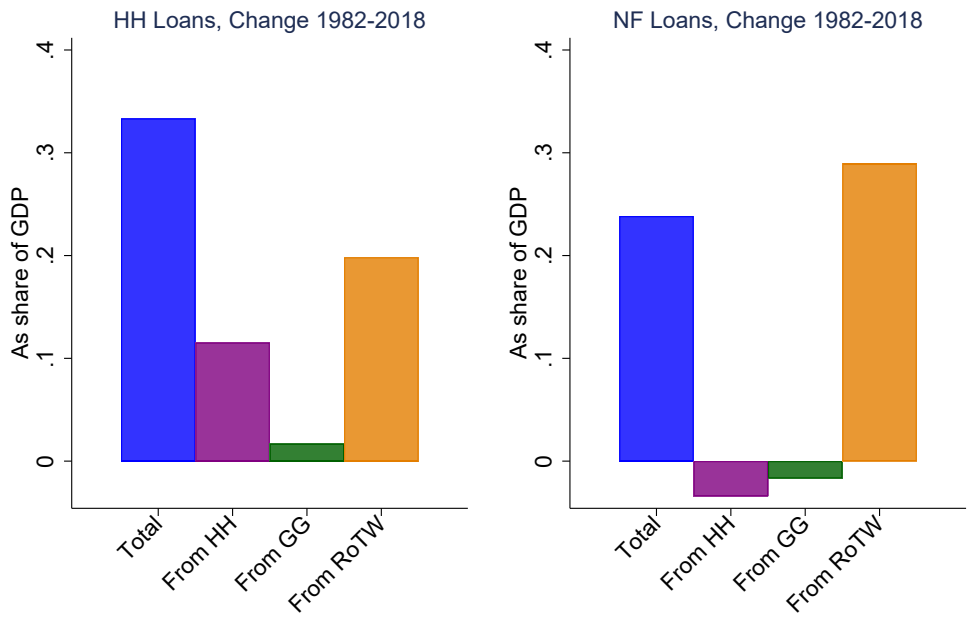
Figure A2.8: *Proportional unveiling compared to consolidated and OECD counterparty unveiling*



The figure shows the relationship between estimates of household credit funded by the foreign sector using different unveiling approaches. The left panel compares the results using the proportional approach to results using the proportional approach on the OECD consolidated Financial Statistics. The right panel compares our baseline to results using recent counterparty information provided by the OECD for selected Countries. Bins are constructed as in Figure A2.3.

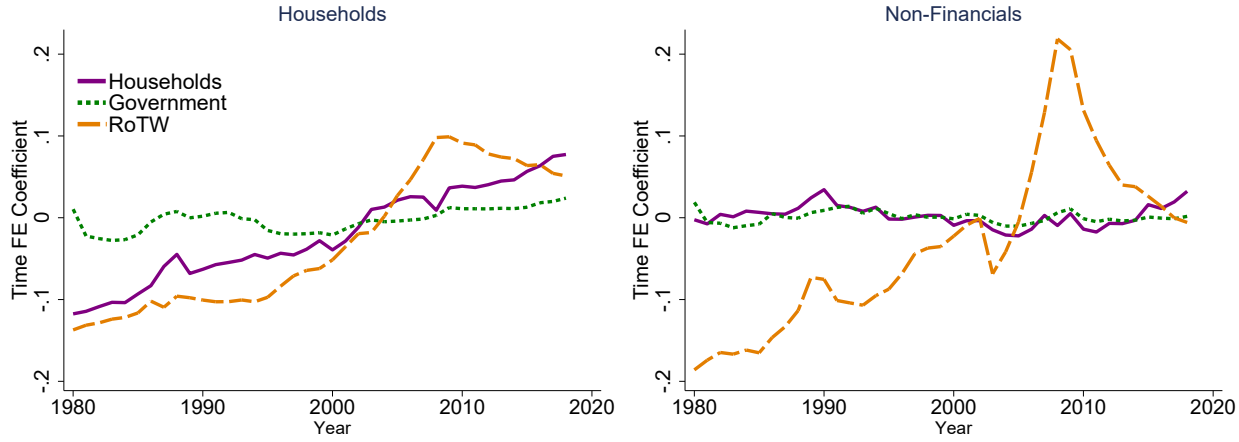
A3. The Changing Nature of Credit Intermediation

Figure A3.9: *Change in credit by source*



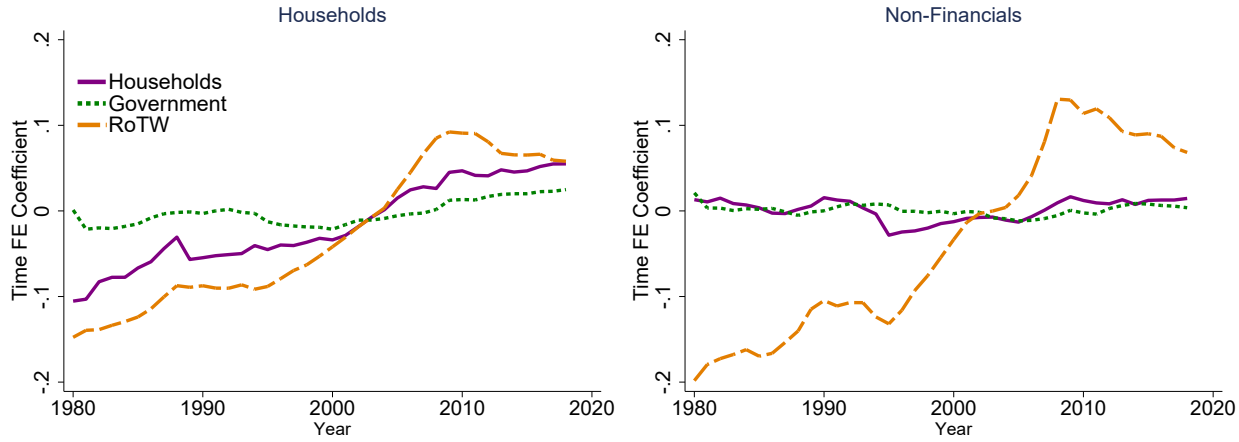
Notes: The figure shows the change in credit-to-GDP by funding source from 1982 to 2018 for a stable sample of countries (Austria, Canada, France, Germany, Japan, Spain, Sweden, and United States). The left panel shows the change in household credit to GDP and how much of this change was financed by the household sector, the government or the rest of the world. The right panel shows the change in loans to the corporate sector relative to GDP and how much of this change was financed by the household sector, the government or the rest of the world.

Figure A3.10: *Fixed Effects of credit by source, excluding Euro-area countries*



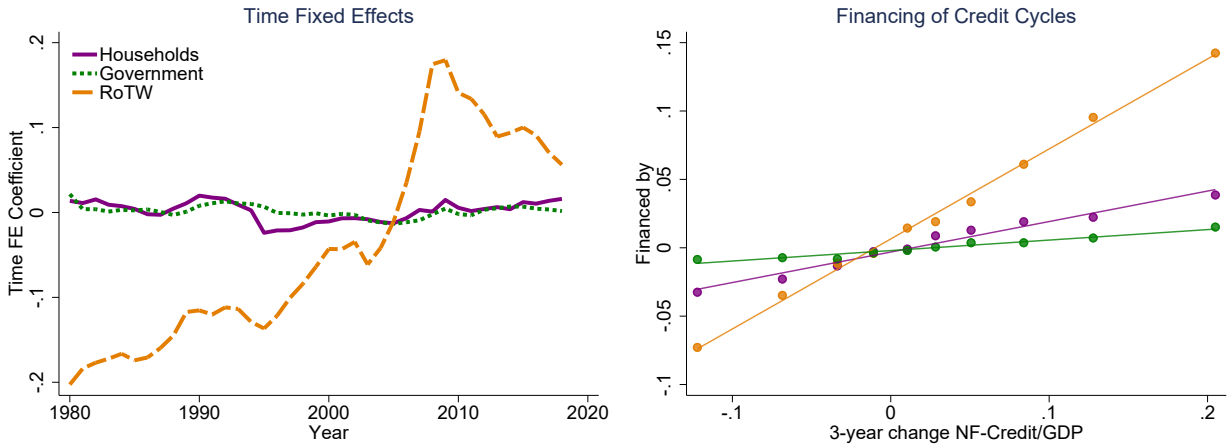
The figure shows time fixed effects for changes in credit by source. Euro area countries are excluded from the sample. The left panel shows the time fixed effects of a regression of household debt-to-GDP by financing sector on country and time fixed effects. The left panel shows the time fixed effects of a regression of loans to non-financial corporates by financing sector on country and time fixed effects.

Figure A3.11: *Fixed Effects of credit by source, excluding countries with large rest of the world sectors*



The figure shows time fixed effects for changes in credit by source. Countries with large rest of the world positions are excluded from the sample (United Kingdom, Switzerland, Ireland, Iceland and the Netherlands). The left panel shows the time fixed effects of a regression of household debt-to-GDP by financing sector on country and time fixed effects. The left panel shows the time fixed effects of a regression of loans to non-financial corporates by financing sector on country and time fixed effects.

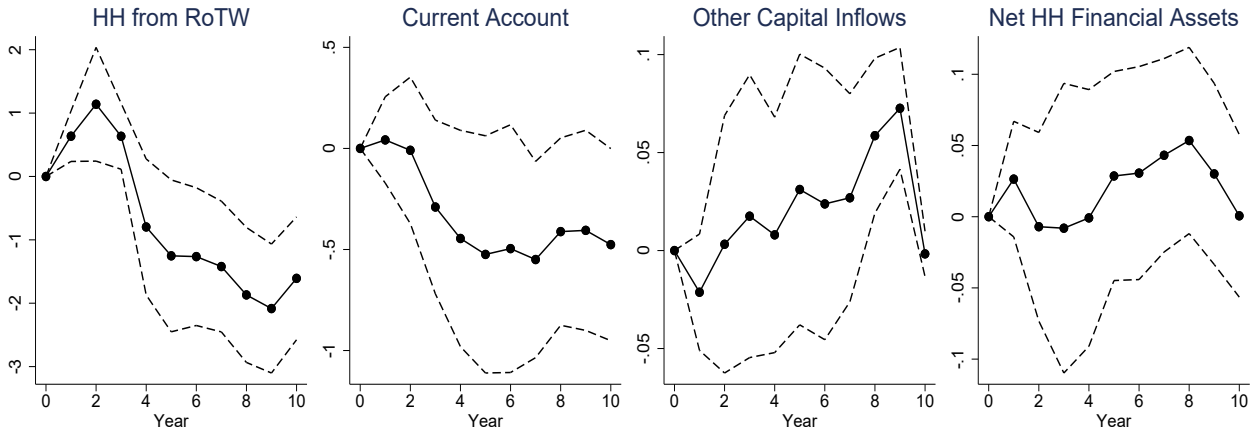
Figure A3.12: *Corporate credit by ultimate counterparty sector: trends and cycles*



Notes: The left panel plots time fixed effects α_t of a regression of non-financial corporate credit by ultimate counterparty sector $C_{i,t}^{u \to NF}$ on country (α_i) and year (α_t) fixed effects, i.e. $C_{i,t}^{u \to NF} = \alpha_i + \alpha_t + \epsilon_{it}$, where u refers to domestic households, government and the foreign sector respectively. The right panel shows the relationship between changes in total non-financial corporate credit and non-financial corporate credit decomposed by ultimate source of funds. Observations are collapsed into 10 equal sized bins based on three-year changes in the ratio of household credit to GDP. Each point represents the group specific means of three-year changes in total non-financial credit and non-financial credit financed by source sectors relative to GDP, after controlling for country fixed effects. Fitted regression lines illustrate the correlation.

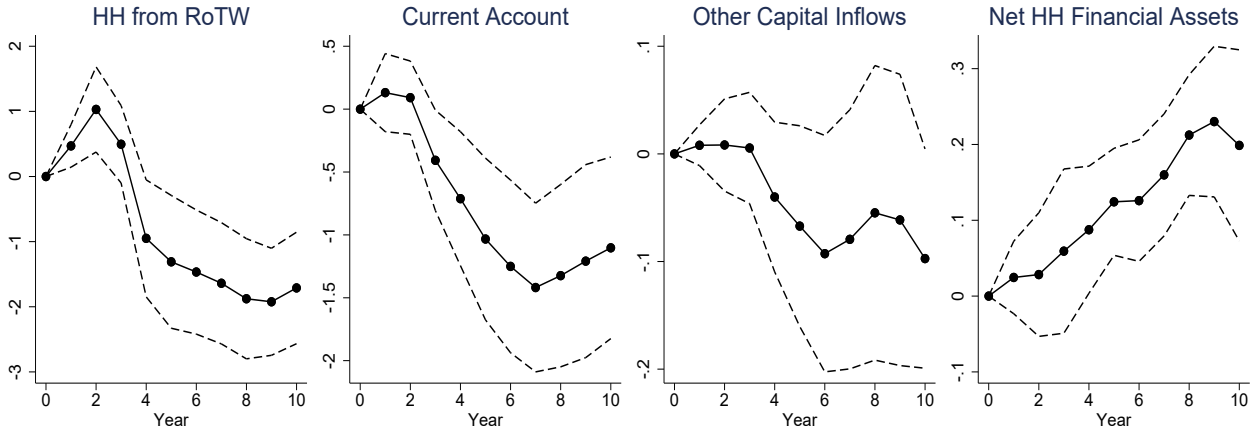
A4. Credit and Business Cycles

Figure A4.13: *GDP responses to changes in foreign financed household credit, the current account, other inflows and net household debt*



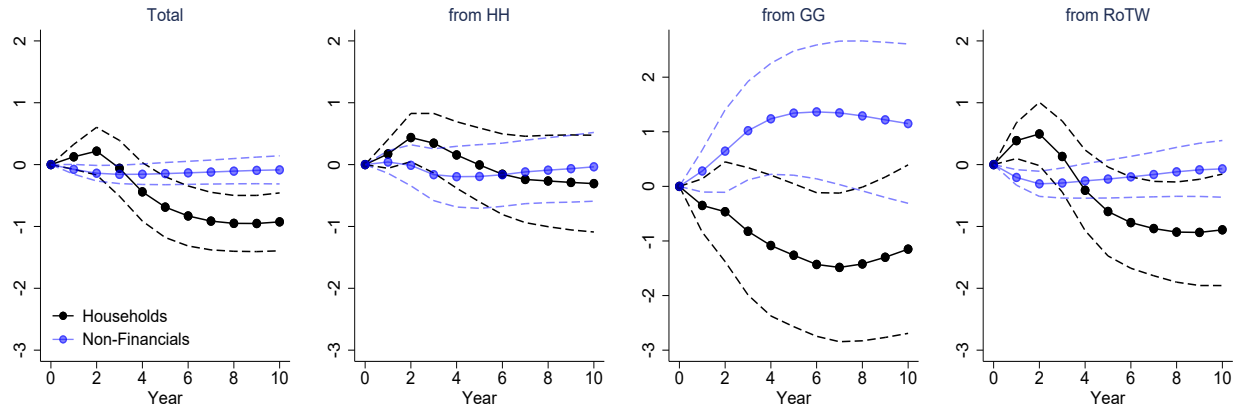
Notes: This figure shows estimates of impulse responses of real GDP (in %) to increases in the ratio of household credit financed from abroad, the (inverse) current account, claims of the rest of the world that are financing something else than household credit, and the change in net household financial assets, to GDP. All responses are estimated jointly in the specification with control variables. Dashed lines represent 95% confidence intervals around estimates computed based on standard errors dually clustered on country and year.

Figure A4.14: *GDP responses to changes in foreign financed household credit, the current account, other inflows and net household debt - excluding credit by counterparty data*



Notes: This figure shows estimates of impulse responses of real GDP (in %) to increases in the ratio of household credit financed from abroad, the (inverse) current account, claims of the rest of the world that are financing something else than household credit, and the change in net household financial assets, to GDP. Responses are estimated only including contemporanoeus values and five lags of the respective variable and of real GDP growth and short-term interest rates. Dashed lines represent 95% confidence intervals around estimates computed based on standard errors dually clustered on country and year.

Figure A4.15: *GDP responses to increases in credit using a SVAR model*



Notes: This figure shows estimates of impulse responses of log real GDP to innovations in the ratio of household (non-fnancial) credit to lagged GDP. The left panel uses a three variable SVAR model with 5 lags of the ordering $(ln(Y)_{i,t}, NF_{i,t-1}, HH_{i,t-1})$, showing the response to household credit in black and non-financial credit in blue. The right three panels use a six variable SVAR model with 5 lags, where both credit variables are decomposed by financing source (rest of the world, domestic households, government) with the ordering $(ln(Y)_{i,t}$, $RoTW \rightarrow NF_{i,t-1}$, $HH \rightarrow NF_{i,t-1}$, $GG \rightarrow NF_{i,t-1}$, $RoTW \rightarrow HH_{i,t-1}$, $HH \rightarrow HH_{i,t-1}$, $GG \rightarrow HH_{i,t-1})$. Responses to household credit are plotted in black, non-financial in blue. Dashed lines represent 95% confidence intervals computed based on monte carlo simulation draws.

Table A4.4: *GDP responses to increases in household credit, excluding countries with large RoTW sectors*

	$\Delta_3 ln(Y)_{i,t+3}$				$\Delta_3 Unemployment_{i,t+3}$			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\Delta_3 RoTW \rightarrow HH_{i,t-1}$	-1.17***	-0.93***	-0.89***	-0.76***	0.42***	0.37***	0.30***	0.28***
	(0.35)	(0.24)	(0.24)	(0.26)	(0.08)	(0.07)	(0.06)	(0.07)
$\Delta_3 HH \rightarrow HH_{i,t-1}$	0.18	0.28*	0.28*	0.22	0.02	0.01	0.01	0.01
	(0.17)	(0.14)	(0.14)	(0.14)	(0.07)	(0.07)	(0.07)	(0.06)
$\Delta_3 GG \rightarrow HH_{i,t-1}$	-0.33	-0.31	-0.28	-0.03	-0.13	-0.11	-0.13	-0.23*
	(0.31)	(0.26)	(0.26)	(0.34)	(0.10)	(0.10)	(0.11)	(0.13)
$\Delta_3 CA_{i,t-1}$			0.16	0.09			-0.18***	-0.17***
			(0.11)	(0.12)			(0.04)	(0.04)
R^2	0.330	0.580	0.583	0.601	0.435	0.589	0.613	0.653
Country fixed effects	✓	✓	✓	✓	✓	✓	✓	✓
LDV	✓	✓	✓	✓	✓	✓	✓	✓
NF Credit	✓	✓	✓	✓	✓	✓	✓	✓
Year fixed effects		✓	✓	✓		✓	✓	✓
Additional Controls				✓				✓
p-value, $\beta_{RoTW} = \beta_{HH} = \beta_{GG}$	0.01	0.00	0.00	0.02	0.00	0.00	0.00	0.01
Observations	603	590	589	522	565	552	551	497

Notes: This table presents results from estimating Equation 2, excluding countries with large foreign sectors from the estimation. The dependent variables are the growth of real GDP and the change in the unemployment rate between year t and $t+3$. Household credit is decomposed by ultimate counterparty sector. Credit variables are expressed as lagged three-year changes in the ratio to GDP. LDV are distributed lags of the dependent variable. NF Credit includes non-financial credit decomposed by ultimate counterparty sector and additional controls include changes in household sector net worth, short-term interest rates and foreign capital not financing household credit. Standard errors in parentheses are dually clustered on country and year. The reported p-value refers to a test for the equality of credit coefficients by counterparty sector. *,**,*** indicates significance at the 0.1, 0.05, 0.01 levels, respectively.

Table A4.5: *Credit expansion and subsequent output, additional results*

	$\Delta_3 ln(Y)_{i,t+3}$							
	Benchmark		By source of HH		Only RoTW to HH		All others	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\Delta_3 HH_{i,t-1}$	-0.45***	-0.30**						
	(0.13)	(0.11)						
$\Delta_3 NF_{i,t-1}$	-0.01	-0.01						
	(0.02)	(0.01)						
$\Delta_3 RoTW \rightarrow HH_{i,t-1}$			-0.90***	-0.67***	-0.77***	-0.64***		
			(0.20)	(0.17)	(0.15)	(0.13)		
$\Delta_3 HH \rightarrow HH_{i,t-1}$			0.21	0.13			-0.08	-0.05
			(0.16)	(0.14)			(0.20)	(0.14)
$\Delta_3 GG \rightarrow HH_{i,t-1}$			-0.45*	-0.10			-0.75**	-0.25
			(0.26)	(0.27)			(0.33)	(0.27)
$\Delta_3 RoTW \rightarrow NF_{i,t-1}$			0.07*	0.03			-0.09***	-0.07***
			(0.04)	(0.03)			(0.02)	(0.02)
$\Delta_3 HH \rightarrow NF_{i,t-1}$			-0.19**	-0.09			-0.10	-0.05
			(0.09)	(0.09)			(0.08)	(0.07)
$\Delta_3 GG \rightarrow NF_{i,t-1}$			0.15	0.30			0.67**	0.60***
			(0.32)	(0.23)			(0.32)	(0.20)
$\Delta_3 Net\ HH_{i,t-1}$	0.01	0.06***	-0.03	0.03			0.04	0.09***
	(0.03)	(0.02)	(0.03)	(0.02)			(0.03)	(0.03)
$\Delta_3 Net\ NF_{i,t-1}$	0.00	-0.02	-0.01	-0.03**			0.02	-0.01
	(0.02)	(0.01)	(0.02)	(0.01)			(0.02)	(0.01)
$\Delta_3 CA_{i,t-1}$	0.29**	0.21*	0.24*	0.17			0.33**	0.25**
	(0.13)	(0.11)	(0.12)	(0.11)			(0.12)	(0.11)
R^2	0.311	0.564	0.363	0.599	0.331	0.572	0.251	0.550
Country fixed effects	✓	✓	✓	✓	✓	✓	✓	✓
LDV	✓	✓	✓	✓	✓	✓	✓	✓
Year fixed effects		✓		✓		✓		✓
Observations	667	663	667	663	678	664	667	663

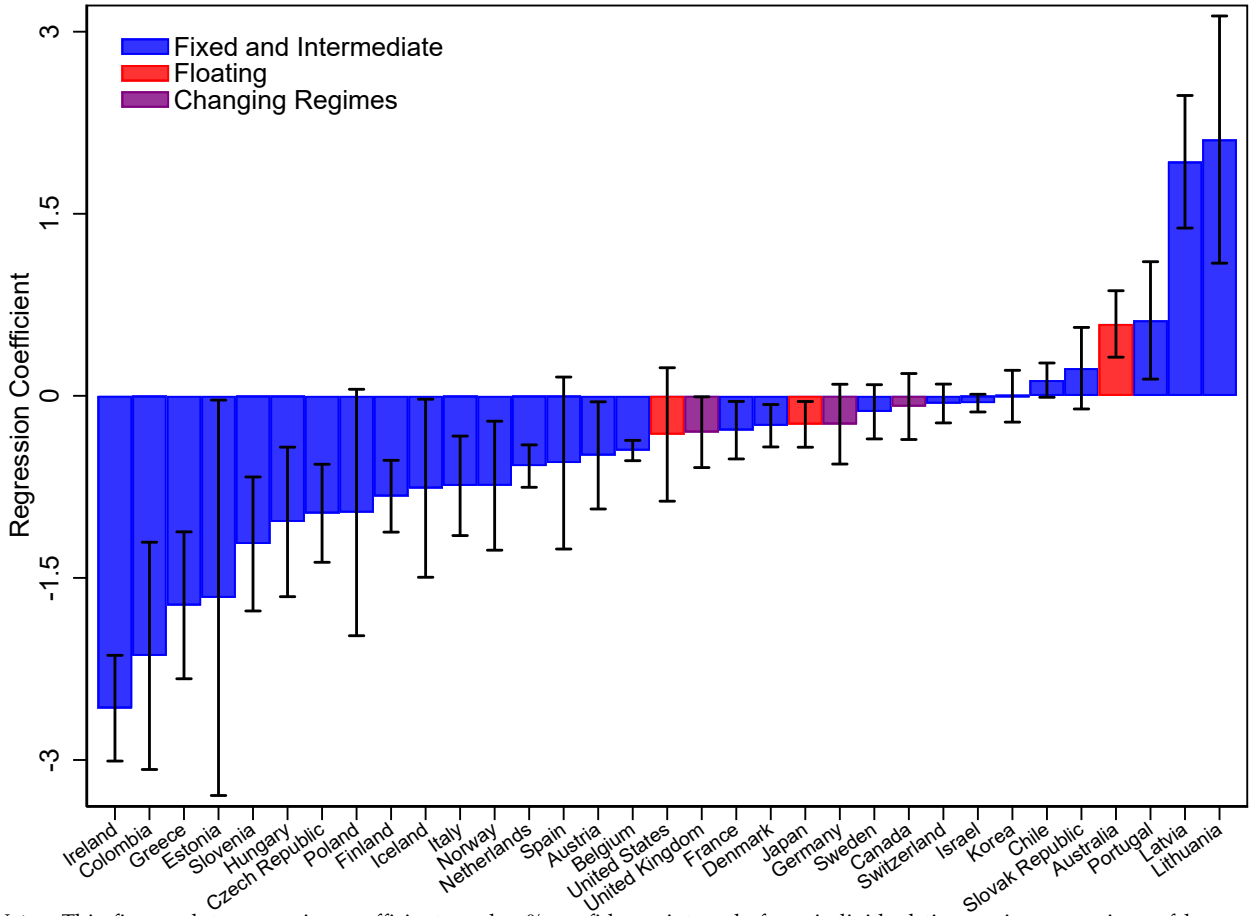
Notes: This table shows predictive regressions of GDP growth on credit expansions. The benchmark specification uses non-decomposed household credit and non-financial credit, as it is standard in the literature. Columns (3) to (4) include credit by counterparty, (5) and (6) only foreign-financed household credit, (7) and (8) exclude foreign-financed household credit. LDV refers to a distributed lag of the dependent variable. Standard errors in parentheses are dually clustered on country and year. *,**,*** indicates significance at the 0.1, 0.05, 0.01 level, respectively. See text.

Table A4.6: *Baseline regressions using different unveiling procedures*

	$\Delta_3 ln(Y)_{i,t+3}$				$\Delta_3 Unemployment_{i,t+3}$			
	Baseline	Counterparty	Subsector	Structural	Baseline	Counterparty	Subsector	Structural
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\Delta_3 RoTW \rightarrow HH_{i,t-1}$	-0.71***	-0.40**	-0.59***	-0.52***	0.19***	0.11***	0.17***	0.14***
	(0.16)	(0.15)	(0.15)	(0.14)	(0.04)	(0.03)	(0.04)	(0.03)
$\Delta_3 HH \rightarrow HH_{i,t-1}$	0.12	0.05	-0.00	-0.22	0.06	-0.03	0.07	0.14
	(0.13)	(0.07)	(0.16)	(0.16)	(0.06)	(0.03)	(0.11)	(0.09)
$\Delta_3 GG \rightarrow HH_{i,t-1}$	0.10	-0.14	0.13	0.32	-0.12	0.06	-0.08	-0.10
	(0.21)	(0.09)	(0.18)	(0.27)	(0.08)	(0.05)	(0.09)	(0.15)
$\Delta_3 CA_{i,t-1}$	0.21*	0.35**	0.23**	0.20*	-0.14***	-0.30***	-0.15***	-0.15***
	(0.11)	(0.16)	(0.11)	(0.11)	(0.03)	(0.08)	(0.04)	(0.04)
R^2	0.595	0.687	0.598	0.595	0.623	0.645	0.626	0.624
Country fixed effects	✓	✓	✓	✓	✓	✓	✓	✓
LDV	✓	✓	✓	✓	✓	✓	✓	✓
NF Credit	✓	✓	✓	✓	✓	✓	✓	✓
Year fixed effects	✓	✓	✓	✓	✓	✓	✓	✓
Additional Controls	✓	✓	✓	✓	✓	✓	✓	✓
p-value, $\beta_{RoTW} = \beta_{HH} = \beta_{GG}$	0.00	0.07	0.02	0.06	0.00	0.04	0.01	0.23
Observations	663	258	632	632	579	236	548	548

Notes: This table shows our baseline regression of GDP growth and changes in the unemployment rate on decomposed credit growth, including our full set of controls. We compare four different unveiling approaches, including counterparty, subsector level and structural unveiling and find our results to be robust to the choice of method. All specifications control for country fixed effects, a distributed lag of the dependent variable, non-financial credit and year fixed effects. Additional controls include changes in household net worth and inflows not financing household credit. Standard errors in parentheses are dually clustered on country and year. *,**,*** indicates significance at the 0.1, 0.05, 0.01 level, respectively. See the appendix for detailed descriptions of the unveiling approaches.

Figure A4.16: *Country-level regression coefficients*



Notes: This figure plots regression coefficients and 90% confidence intervals from individual time series regressions of log real GDP growth from t to $t+3$ on Household credit decomposed by funding source $u \in$ (HH, GG, RoTW) and non-financial credit. The shown coefficients are for household credit funded by the rest of the world $\Delta_3 RoTW \rightarrow HH_{i,t-1}$. Variables are standardized by country prior to the regression. We use Newey-West Standard Errors with a maximum lag length of 6. The specification $\Delta_3 y_{i,t+3} = \alpha + \sum_{u \in U} \beta^s \Delta_3 C^{u \rightarrow HH}_{i,t-1} + \beta^{NF} \Delta_3 C^{NF}_{i,t-1} + u_{i,t+3}$ is estimated on individual country time series. The bars colored in red indicate countries consistently classified as floating exchange rate regimes by Ilzetzki et al. (2019). Countries in blue are consistently classified as either pegged or intermediate regimes, while purple colored bars indicated countries that switched to or from a floating exchange regime during our sample period.

Table A4.7: *Credit expansion and sectoral reallocation*

	$\Delta_3 ln(\frac{Y_{NT}}{Y_T})_{i,t}$		$\Delta_3 ln(\frac{Emp_{NT}}{Emp_T})_{i,t}$		$\Delta_3 ln(\frac{Inv_{Housing}}{Inv_{Other}})_{i,t}$	
	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta_3 RoTW \rightarrow HH_{i,t}$	0.56***	0.57***	0.14**	0.20***	1.01***	1.25***
	(0.12)	(0.14)	(0.06)	(0.06)	(0.36)	(0.39)
$\Delta_3 HH \rightarrow HH_{i,t}$	0.08	-0.06	0.36***	0.35***	1.21***	0.98
	(0.21)	(0.22)	(0.10)	(0.12)	(0.41)	(0.69)
$\Delta_3 GG \rightarrow HH_{i,t}$	0.20	0.10	0.59***	0.58***	0.70	0.36
	(0.23)	(0.22)	(0.15)	(0.16)	(0.82)	(0.85)
$\Delta_3 RoTW \rightarrow NF_{i,t-1}$	-0.01	0.05	0.06	0.06	-0.09	-0.10
	(0.12)	(0.12)	(0.04)	(0.05)	(0.11)	(0.12)
$\Delta_3 HH \rightarrow NF_{i,t-1}$	0.15	0.06	0.14	0.15*	0.45	0.25
	(0.14)	(0.12)	(0.09)	(0.09)	(0.33)	(0.45)
$\Delta_3 GG \rightarrow NF_{i,t-1}$	-0.11	0.02	-0.33*	-0.36*	-1.46	-1.00
	(0.24)	(0.24)	(0.19)	(0.20)	(1.15)	(1.25)
R^2	0.249	0.283	0.324	0.332	0.234	0.244
Country fixed effects	✓	✓	✓	✓	✓	✓
Additional Controls		✓		✓		✓
p-value, $\beta_{RoTW,HH} = \beta_{GG,HH} = \beta_{HH,HH}$	0.08	0.05	0.02	0.12	0.87	0.58
Observations	620	618	584	582	733	676

Notes: The dependent variables are three-year changes in the log ratio of output (employment, investment) in the non-tradable to tradable sectors between t and $t-3$. For investment, investment in the construction of dwellings (housing) is considered as non-tradable. Credit variables are expressed as contemporaneous three year changes in the ratio of credit to GDP. Additional controls include the current account, changes in household sector net worth and foreign capital not financing household credit. Standard errors in parentheses are dually clustered on country and year. *,**,*** indicates significance at the 0.1, 0.05, 0.01 level, respectively.

A5. Crisis

Table A5.8: *Predicting financial crises: linear probability models*

	Baseline		By counterparty		Only RoTW to HH		All others	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\Delta_3 HH_{i,t-1}$	0.27***	0.32***						
	(0.08)	(0.09)						
$\Delta_3 NF_{i,t-1}$	0.07***	0.05***						
	(0.02)	(0.02)						
$\Delta_3 RoTW \to HH_{i,t-1}$			0.62***	0.60***	0.62***	0.62***		
			(0.12)	(0.13)	(0.09)	(0.10)		
$\Delta_3 GG \to HH_{i,t-1}$			-0.33	-0.19			-0.04	0.14
			(0.35)	(0.42)			(0.33)	(0.40)
$\Delta_3 HH \to HH_{i,t-1}$			-0.26	-0.17			-0.02	0.07
			(0.34)	(0.40)			(0.33)	(0.38)
$\Delta_3 RoTW \to NF_{i,t-1}$			-0.02	-0.01			0.10***	0.11***
			(0.04)	(0.04)			(0.04)	(0.04)
$\Delta_3 GG \to NF_{i,t-1}$			0.12	-0.08			-0.21	-0.44
			(0.39)	(0.46)			(0.41)	(0.48)
$\Delta_3 HH \to NF_{i,t-1}$			0.16	0.17			0.10	0.11
			(0.22)	(0.25)			(0.22)	(0.26)
$\Delta_3 CA_{i,t-1}$	-0.20	-0.22	-0.15	-0.17			-0.29*	-0.30
	(0.15)	(0.15)	(0.15)	(0.15)			(0.17)	(0.18)
AUC	0.75	0.81	0.80	0.85	0.80	0.85	0.76	0.81
s.e.	0.05	0.04	0.05	0.04	0.05	0.04	0.05	0.04
Country fixed effects		✓		✓		✓		✓
Observations	739	739	739	739	739	739	739	739

Notes: The table shows linear classification models where the dependent variable is a financial crisis dummy. AUC is the area under the ROC-curve and below is its standard error. Standard errors in parentheses are clustered by country. *,**,*** indicates significance at the 0.1, 0.05, 0.01 levels, respectively.

Table A5.9: *Predicting financial crises and banking panics: Baron et al. (2021) crisis chronology*

	Baseline		By counterparty		Only RoTW to HH		All others	
	Crisis	Panic	Crisis	Panic	Crisis	Panic	Crisis	Panic
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\Delta_3 HH_{i,t-1}$	0.32**	0.27***						
	(0.13)	(0.10)						
$\Delta_3 NF_{i,t-1}$	0.06*	0.04						
	(0.03)	(0.02)						
$\Delta_3 RoTW \rightarrow HH_{i,t-1}$			0.60***	0.59***	0.60***	0.57***		
			(0.10)	(0.10)	(0.08)	(0.08)		
$\Delta_3 GG \rightarrow HH_{i,t-1}$			0.36	-0.24			0.75	0.15
			(0.48)	(0.46)			(0.50)	(0.47)
$\Delta_3 HH \rightarrow HH_{i,t-1}$			-0.32	-0.27			-0.25	-0.20
			(0.30)	(0.22)			(0.31)	(0.25)
$\Delta_3 RoTW \rightarrow NF_{i,t-1}$			-0.06	-0.10**			0.07	0.04
			(0.06)	(0.04)			(0.05)	(0.04)
$\Delta_3 GG \rightarrow NF_{i,t-1}$			0.53	0.39			-0.06	-0.20
			(0.52)	(0.40)			(0.49)	(0.43)
$\Delta_3 HH \rightarrow NF_{i,t-1}$			0.22	0.26			0.25	0.27
			(0.23)	(0.17)			(0.26)	(0.20)
$\Delta_3 CA_{i,t-1}$	-0.28	-0.55**	-0.32	-0.57**			-0.47*	-0.71***
	(0.31)	(0.23)	(0.27)	(0.24)			(0.25)	(0.21)
AUC	0.69	0.77	0.72	0.83	0.69	0.78	0.67	0.74
s.e.	0.04	0.04	0.04	0.04	0.05	0.05	0.04	0.04
Observations	631	631	631	631	631	631	631	631

Notes: The table shows probit classification models where the dependent variable is either a dummy for financial crisis or banking panics, classified by Baron et al. (2021). Panics are defined as 'episodes of severe and sudden withdrawals of funding by bank creditors from a significant part of the banking system'. Coefficients are mean marginal effects. AUC is the area under the ROC-curve and below is its standard error. Standard errors in parentheses are clustered by country. *,**,*** indicates significance at the 0.1, 0.05, 0.01 levels, respectively.

A6. Channels

Table A6.10: *Credit expansion and subsequent outcomes, non-linearity*

	$\Delta_3 ln(Y)_{i,t+3}$				$\Delta_3 Unemployment_{i,t+3}$			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\Delta_3 RotW \rightarrow HH_{i,t-1} * 1(\geq 0)$	-1.23***	-0.99***	-0.95***	-0.88***	0.35***	0.32***	0.28***	0.24***
	(0.28)	(0.24)	(0.23)	(0.23)	(0.08)	(0.06)	(0.06)	(0.05)
$\Delta_3 RotW \rightarrow HH_{i,t-1} * 1(< 0)$	0.31	0.07	-0.00	-0.11	0.04	0.05	0.08	0.11**
	(0.39)	(0.33)	(0.32)	(0.34)	(0.09)	(0.07)	(0.06)	(0.05)
$\Delta_3 GG \rightarrow HH_{i,t-1} * 1(\geq 0)$	-0.46	-0.27	-0.02	0.24	-0.08	-0.11	-0.21	-0.29*
	(0.56)	(0.46)	(0.46)	(0.44)	(0.16)	(0.15)	(0.14)	(0.16)
$\Delta_3 GG \rightarrow HH_{i,t-1} * 1(< 0)$	-0.47	-0.36	-0.45	-0.11	0.13	0.04	0.07	-0.10
	(0.49)	(0.41)	(0.41)	(0.43)	(0.14)	(0.16)	(0.14)	(0.12)
$\Delta_3 HH \rightarrow HH_{i,t-1} * 1(\geq 0)$	-0.03	0.17	0.25	0.19	0.02	-0.01	-0.05	-0.03
	(0.32)	(0.24)	(0.23)	(0.25)	(0.10)	(0.09)	(0.10)	(0.10)
$\Delta_3 HH \rightarrow HH_{i,t-1} * 1(< 0)$	0.53*	0.23	0.14	0.18	0.02	0.07	0.11	0.10
	(0.28)	(0.28)	(0.30)	(0.33)	(0.09)	(0.10)	(0.09)	(0.10)
$\Delta_3 RotW \rightarrow NF_{i,t-1} * 1(\geq 0)$	0.06	0.09**	0.10**	0.06	-0.03	-0.04**	-0.05***	-0.03*
	(0.06)	(0.04)	(0.04)	(0.05)	(0.02)	(0.02)	(0.02)	(0.02)
$\Delta_3 RotW \rightarrow NF_{i,t-1} * 1(< 0)$	-0.02	-0.06	-0.05	-0.04	-0.02	-0.01	-0.02	-0.02
	(0.06)	(0.05)	(0.05)	(0.05)	(0.02)	(0.02)	(0.02)	(0.01)
$\Delta_3 GG \rightarrow NF_{i,t-1} * 1(\geq 0)$	0.67	0.40	0.34	0.12	-0.05	0.03	0.07	0.13
	(0.55)	(0.38)	(0.35)	(0.35)	(0.18)	(0.13)	(0.11)	(0.11)
$\Delta_3 GG \rightarrow NF_{i,t-1} * 1(< 0)$	-0.05	0.45	0.42	0.05	0.14	0.00	0.02	0.16*
	(0.46)	(0.38)	(0.37)	(0.38)	(0.14)	(0.13)	(0.11)	(0.08)
$\Delta_3 HH \rightarrow NF_{i,t-1} * 1(\geq 0)$	-0.18	-0.03	-0.01	0.04	0.16***	0.09	0.07	0.01
	(0.22)	(0.17)	(0.17)	(0.17)	(0.06)	(0.06)	(0.06)	(0.08)
$\Delta_3 HH \rightarrow NF_{i,t-1} * 1(< 0)$	-0.20	-0.28**	-0.26*	-0.16	0.10	0.13**	0.12**	0.07
	(0.17)	(0.13)	(0.13)	(0.21)	(0.06)	(0.05)	(0.04)	(0.06)
$\Delta_3 CA_{i,t-1} * 1(\geq 0)$			-0.14	-0.27			-0.03	-0.01
			(0.22)	(0.23)			(0.05)	(0.05)
$\Delta_3 CA_{i,t-1} * 1(< 0)$			0.61*	0.68*			-0.35***	-0.37***
			(0.31)	(0.35)			(0.10)	(0.12)
R^2	0.400	0.601	0.612	0.637	0.436	0.591	0.623	0.668
Country fixed effects	✓	✓	✓	✓	✓	✓	✓	✓
LDV	✓	✓	✓	✓	✓	✓	✓	✓
Year fixed effects		✓	✓	✓		✓	✓	✓
Additional Controls				✓				✓
Observations	678	664	663	596	688	675	674	604

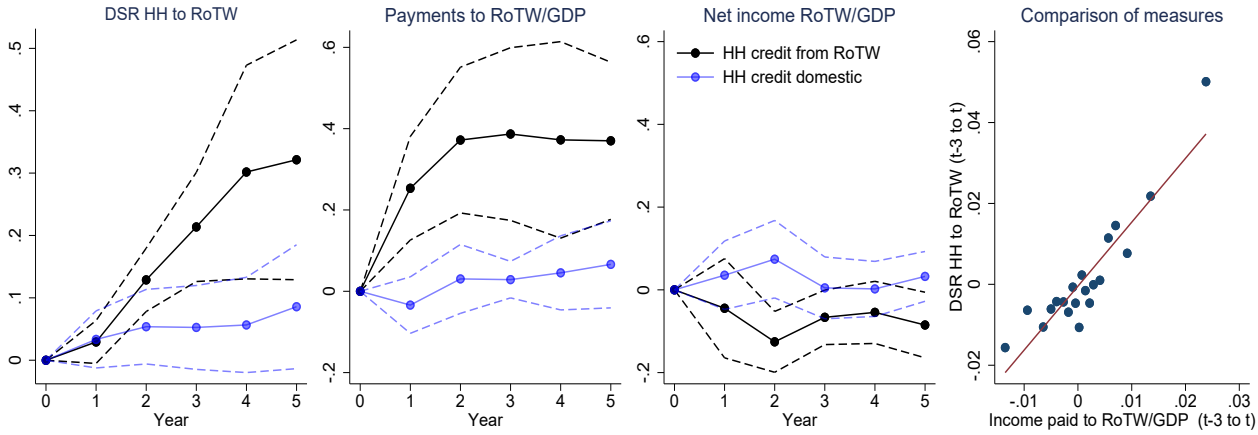
Notes: The dependent variables in this table are real GDP growth and changes in the unemployment rate between t and $t+3$. This table tests for potential non-linearity in the relationship between credit and the business cycle, by estimating separate coefficients for positive and negative changes for household debt for our full set of counterparty sectors. Standard errors in parentheses are dually clustered on country and year. *,**,*** indicates significance at the 0.1, 0.05, 0.01 levels, respectively

Table A6.11: *Debt service payments to foreigners and gross payable incomes to RoTW increase in foreign financed household credit expansions*

	$DSR^{HH \to RoTW}_{i,t}$		$Pay \to RoTW_{i,t}$			
	DSR Sample		DSR Sample		Full Sample	
	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta_3 RoTW \to HH_{i,t-1}$	0.11***	0.12***	0.09**	0.16***	0.16***	0.19***
	(0.01)	(0.01)	(0.04)	(0.03)	(0.02)	(0.03)
$\Delta_3 DM \to HH_{i,t-1}$	0.00	0.00	-0.05	-0.05	-0.09*	-0.10
	(0.01)	(0.01)	(0.06)	(0.05)	(0.05)	(0.06)
$\Delta_3 NF_{i,t-1}$	0.01*	0.01*	0.03	0.03	0.00	-0.00
	(0.01)	(0.00)	(0.03)	(0.02)	(0.01)	(0.01)
Country fixed effects	✓	✓	✓	✓	✓	✓
Lagged GDP Growth	✓	✓	✓	✓	✓	✓
LDV	✓	✓	✓	✓	✓	✓
Additional Controls		✓		✓		✓
p-value, $\beta_{RoTW} = \beta_{DM}$	0.00	0.00	0.06	0.01	0.00	0.00
Observations	218	218	218	218	726	670

Notes: The dependent variables are debt service ratios with foreign counterparties from (1) to (2) and gross payments to the rest of the world in year t from (3) to (6). Samples where both variables are available are reported separately from the full sample for payments to the rest of the world. The independent variables are changes in household credit, decomposed into foreign and domestically financed, and non-financial credit between $t-4$ and $t-1$. Additional controls include changes in the current account and household sector net worth. All specifications control for country fixed effects a distributed lag of GDP growth and the dependent variable in $t-4$. Standard errors in parentheses are dually clustered on country and year. *,**,*** indicates significance at the 0.1, 0.05, 0.01 level, respectively.

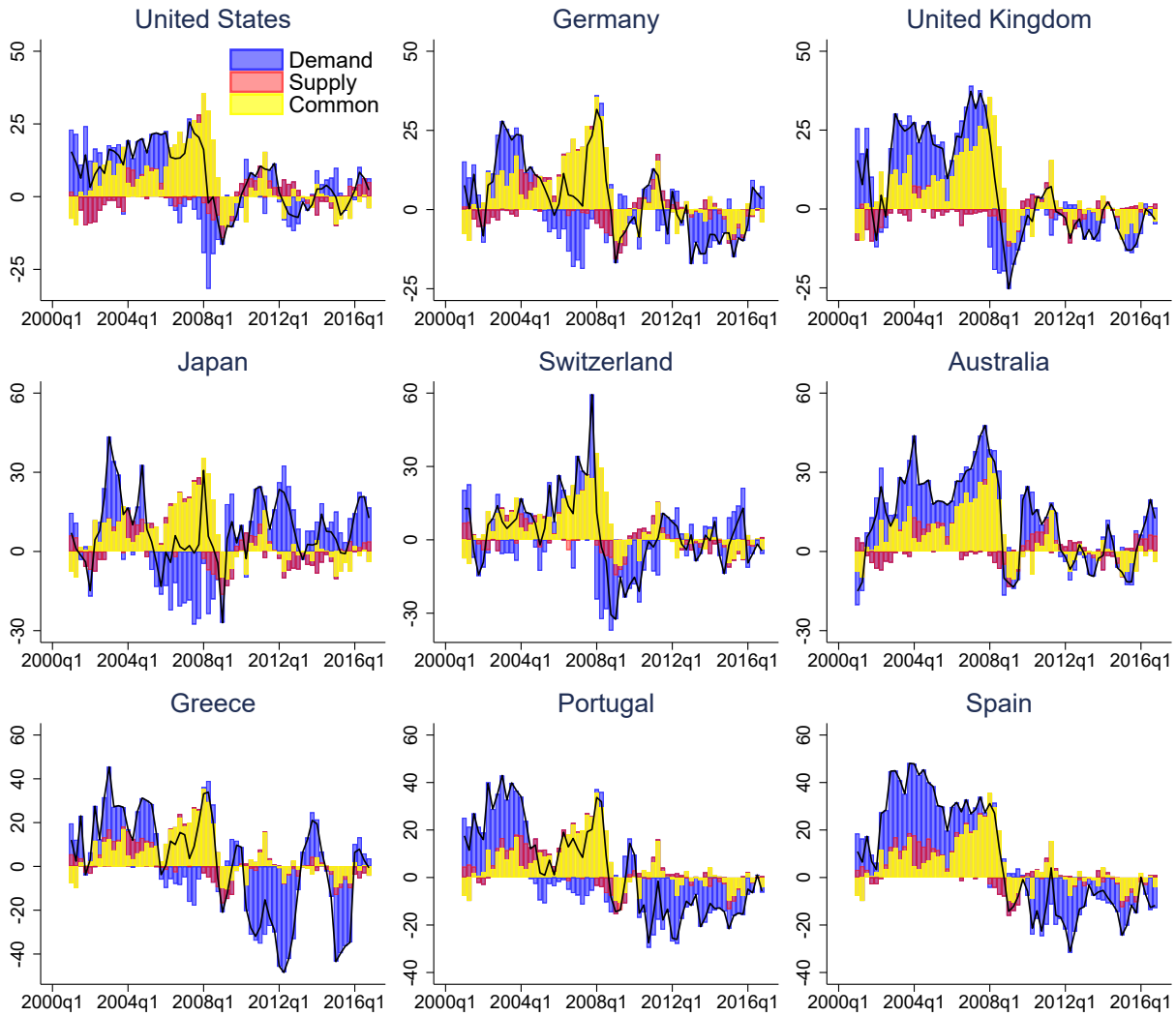
Figure A6.17: *Credit and debt service payments to RoTW*



Notes: The three left panels show the relationships between household credit financed from the RoTW and subsequent payment flows. The left panel shows the response of debt service payments attributed to the RoTW to an increase in household credit financed from the RoTW (black) or from domestic sources (blue). The two middle panels show the response of gross primary incomes payable to RoTW (second panel) and net primary incomes from RoTW (third panel). The right panel shows the relationship between debt service payments attributable to RoTW and gross primary incomes payable to RoTW. See text.

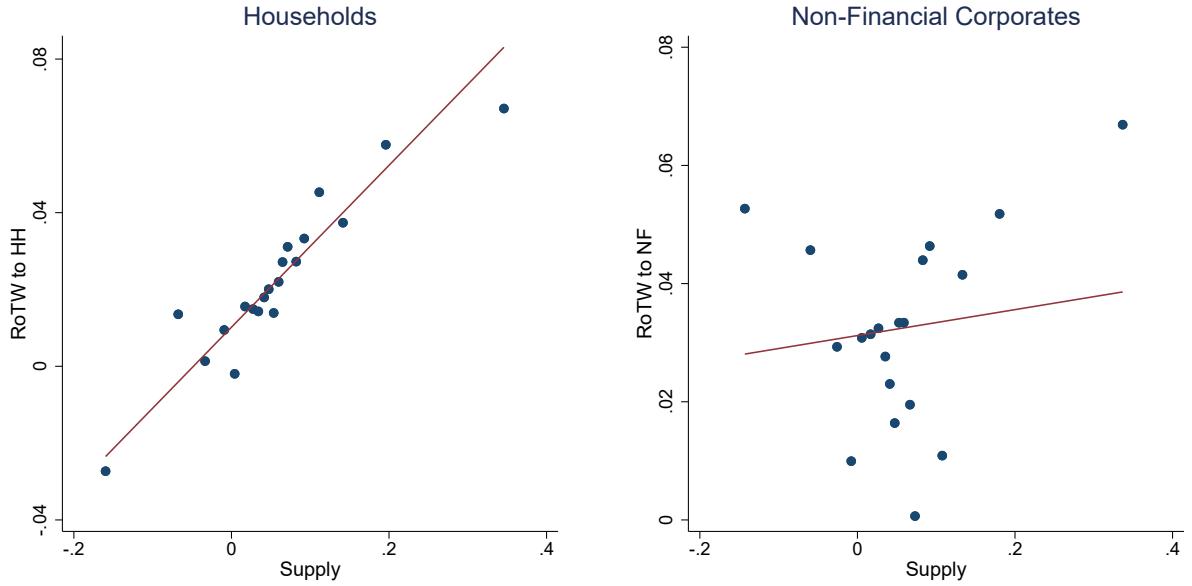
A7. Amiti-Weinstein decomposition and instrumental variable results

Figure A7.18: *Amiti-Weinstein shock decomposition for selected developed economies*



Notes: This figure shows the year-on-year growth in claims of all reporting banks from the BIS locational banking statistics, on the country listed in the panel header. The total growth is decomposed into (i) estimated demand shocks (blue), unique to the borrower country listed in the panel header (ii) supply shocks based on weighted supply shocks to the banking systems that have outstanding claims on the borrower country listed in the title, (iii) shocks that are common to all banking systems and borrower countries. This figure includes the same set of countries as Figure 10 in Amiti et al. (2019).

Figure A7.19: *Binned scatterplots for first-stage*



Notes: This figure shows the relationship between changes in foreign-financed household credit to GDP and accumulated supply shocks between $t-4$ and $t-1$. Observations are collapsed into 20 equal sized bins, with each point representing the group specific mean. We control for country fixed effects, household credit ultimately funded by domestic counterparties and non-financial credit. Fitted regression lines illustrate the correlation.

Table A7.12: *Foreign-financed household credit and business cycle dynamics - foreign supply of funds - excluding large economies*

	$\Delta_3 ln(Y)_{i,t+3}$				$\Delta_3 Unemployment_{i,t+3}$			
	Baseline	*Reduced*	*IV*	*IV*	*Baseline*	*Reduced*	*IV*	*IV*
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\Delta_3 RoTW \rightarrow HH_{i,t-1}$	-0.93***		-2.20***	-2.19***	0.27***		0.33***	0.30***
	(0.19)		(0.79)	(0.80)	(0.04)		(0.08)	(0.08)
$\Delta_3 Supply_{i,t-1}$		-0.25***				0.06***		
		(0.06)				(0.02)		
$\Delta_3 HH \rightarrow HH_{i,t-1}$	0.01	-0.40*	0.48	0.48	0.09	0.23*	0.05	0.05
	(0.20)	(0.21)	(0.40)	(0.40)	(0.09)	(0.12)	(0.09)	(0.09)
$\Delta_3 GG \rightarrow HH_{i,t-1}$	-0.41	-0.48*	-0.18	-0.17	-0.03	-0.06	-0.04	-0.03
	(0.27)	(0.26)	(0.44)	(0.44)	(0.08)	(0.09)	(0.08)	(0.08)
$\Delta_3 CA_{i,t-1}$				0.04				-0.13***
				(0.13)				(0.05)
Country fixed effects	✓	✓	✓	✓	✓	✓	✓	✓
LDV	✓	✓	✓	✓	✓	✓	✓	✓
NF Credit	✓	✓	✓	✓	✓	✓		✓
Kleibergen-Paap Weak ID	.	.	16.07	17.50	.	.	7.49	8.18
Observations	498	498	498	498	465	465	465	464

Notes: The dependent variable is GDP growth from t to $t+3$ in (1)-(4) and changes in unemployment between t and $t+3$ in (5)-(8). Columns (1) and (5) are based on Equation 2. Columns (2) and (6) replace $\Delta_3 RoTW \rightarrow HH_{i,t-1}$ with the supply shock measure. Columns (3)-(4) and (7)-(8) use the supply shock measure as an instrumental variable for $\Delta_3 RoTW \rightarrow HH_{i,t-1}$. This specification excludes the United States, Germany, France, Japan and the UK. All specifications control for country fixed effects and a distributed lag of the dependent variable (LDV). NF-credit controls for non-financial credit. Standard errors in parentheses are dually clustered on country and year. *,**,*** indicates significance at the 0.1, 0.05, 0.01 level, respectively.

Table A7.13: *Foreign-financed household credit and business cycle dynamics - foreign supply of funds - excluding major suppliers of safe assets*

	$\Delta_3 ln(Y)_{i,t+3}$				$\Delta_3 Unemployment_{i,t+3}$			
	Baseline	*Reduced*	*IV*	*IV*	*Baseline*	*Reduced*	*IV*	*IV*
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\Delta_3 RoTW \rightarrow HH_{i,t-1}$	-0.88***		-1.89***	-1.85***	0.25***		0.30***	0.28***
	(0.18)		(0.55)	(0.56)	(0.04)		(0.07)	(0.07)
$\Delta_3 Supply_{i,t-1}$		-0.26***				0.06***		
		(0.06)				(0.02)		
$\Delta_3 HH \rightarrow HH_{i,t-1}$	0.02	-0.30	0.26	0.26	0.10	0.20**	0.08	0.07
	(0.16)	(0.19)	(0.27)	(0.26)	(0.08)	(0.10)	(0.08)	(0.08)
$\Delta_3 GG \rightarrow HH_{i,t-1}$	-0.29	-0.37	-0.06	-0.05	-0.02	-0.04	-0.03	-0.03
	(0.26)	(0.27)	(0.36)	(0.36)	(0.07)	(0.08)	(0.07)	(0.07)
$\Delta_3 CA_{i,t-1}$				0.14				-0.14***
				(0.13)				(0.05)
Country fixed effects	✓	✓	✓	✓	✓	✓	✓	✓
LDV	✓	✓	✓	✓	✓	✓	✓	✓
NF Credit	✓	✓	✓	✓	✓	✓	✓	✓
Kleibergen-Paap Weak ID	.	.	22.12	23.00	.	.	11.44	12.29
Observations	590	590	590	590	554	554	554	553

Notes: The dependent variable is GDP growth from t to $t+3$ in (1)-(4) and changes in unemployment between t and $t+3$ in (5)-(8). Columns (1) and (5) are based on Equation 2. Columns (2) and (6) replace $\Delta_3 RoTW \rightarrow HH_{i,t-1}$ with the supply shock measure. Columns (3)-(4) and (7)-(8) use the supply shock measure as an instrumental variable for $\Delta_3 RoTW \rightarrow HH_{i,t-1}$. This specification excludes the United States and Germany. All specifications control for country fixed effects and a distributed lag of the dependent variable (LDV). NF-credit controls for non-financial credit. Standard errors in parentheses are dually clustered on country and year. *,**,*** indicates significance at the 0.1, 0.05, 0.01 level, respectively.